University Chronicle

VOL. IV MAY, 1901 No. 2

GOVERNMENT BY PUBLIC OPINION.*

By ARTHUR TWINING HADLEY.

There are two quite distinct theories of democratic government; the individualistic and the socialistic. The former relies mainly on the self-interest of the various citizens, acting independently, as a means of determining and promoting the general welfare. The latter relies mainly on the votes of those citizens acting as a body. The individualist believes that the selfish conduct of each man and woman, if properly enlightened and subjected to a certain necessary minimum of restraint, can be trusted to work out results which will conduce to the good of the body politic. The socialist believes that this good must be sought by the collective action of the people; and that the machinery of government, by giving effect to those measures which, after proper discussion, the majority of the people believe to be desirable, is the agency on which we must place our chief confidence for the solution of political and industrial problems.

Most thoughtful men would agree that neither of these theories has proved wholly satisfactory.

Of the individualistic theory, this is now quite universally admitted. Even those who recognize most clearly what self-interest has done for political and industrial progress

*An address delivered at the Charter Day exercises of the University of California, March 23, 1901.

are compelled to acknowledge that it will not do everything. Its successes have been great; but they have not been unmixed with failures. It is a powerful stimulant; but it is by no means that panacea for social ills which so many economists and moralists have considered it. The exalted hopes of the individualistic philosophers during the first half of the nineteenth century have been followed during the second half by a depressing reaction.

Down to the beginning of that century, business had been hedged about by a multitude of restrictions which had been thought necessary for the general good. The removal of these restrictions proved to be of great benefit. By giving a man, as far as possible, the right to enjoy what he produced, we furnished him the best motive to work. We were thus able to dispense with the necessity of serfdom, and obtained much more effective service under free labor than ever was possible under compulsion. By guaranteeing a man the right to the unhampered use of what he possessed, we stimulated the accumulation of capital, and thus developed new methods of production which helped the community even more than they enriched the individual possessor. We were able to arrange a system of competition which prevented trade from degenerating into a fight between buyer and seller, and utilized it as a means of mutual advantage. The institution of private property was thus made a vast machine for turning self-interest to the service of the body politic. The literature of political economy, in the hands of Adam Smith and his successors, was occupied with developing the advantages of economic freedom; in other words, with showing how the enlightened selfishness of each individual could be made to contribute to the good of others as well as of himself.

Nor have these theories been confined to the field of economics. Outside of the realm of business, we have been developing moral precepts based on the same sort of selfishness. Instead of compelling the people to obey laws because they were imposed by a superior authority, we have

striven to show that they have a personal interest in obeying such laws—that by a violation of public advantage they will in the long run hurt themselves scarcely less than they hurt others. Not a few writers have gone so far as to proclaim that this is the only rational basis of social obligations, and that the attempt to impose any other theory upon a democratic community is an insult to its intelligence.

The restrictions contained in the old systems of class legislation, both in business and in personal conduct, had been so arbitrary that their abolition was of itself an improvement, and a moderately enlightened degree of self-interest could hardly fail of producing better business and better conduct. But as matters have advanced farther, we see that the consequences of this freedom, though preferable to the system which they superseded, are not in every respect ideal. What might result if all men were sufficiently intelligent to work them out to the best advantage is a doubtful question, which I shall not attempt to discuss. What does result, under the existing degree of intelligence, is a mixture of good and evil, better than that which existed a century ago, but far short of anything with which we can rest satisfied. Even in the field of economics we have learned that the coincidence of private interest and public interest cannot be made complete. However much we may preach the blessings of competition, we find that there are many cases in which competition will not work. However warmly we may champion the benefits of free labor and free capital, we reach a stage of development where the one cannot be obtained without a considerable sacrifice of the other. We have come to a point where we regard the principles of political economy in their true light, as a valuable scientific discovery, but not in their false light, as a cure for every industrial wrong.

The failure of the socialistic principle of government by the will of the majority is less universally admitted. The theory seems so plausible that people are inclined to overlook its historical fallacies and its practical failures.

Modern democracy has in its hands a vast political machinery, the legacy left by the monarchical or aristocratic systems of government which it has superseded. The social democrats believe that by the use of this machinery the voters can obtain all the benefits which the older system enjoyed in the way of coherent power, and that they can at the same time avoid the perversion of that power to destroy personal liberty, because authority is now vested in the whole body of citizens, instead of in a single class.

But the power for good, thus held by modern democracy, is in some respects more apparent than real. The machinery of government is a vast and complex thing, but it is not one which will run itself. It has to have force behind it. In a monarchy or an aristocracy it is easy to see where the force comes from. It is based on the superior military strength of a single individual or a single class. Where one man was preëminent above all others in his fighting power, he had the means of making his will respected at home no less than it was feared abroad. This state of things was seen in Homeric society. When Hector fell, all the Trojans ran; when Achilles fell, all the Greeks ran. It was a necessary consequence that the affairs of the home government were chiefly ordered by men like Hector and Achilles, in the interests of the families which they represented. Where military power was somewhat more widely diffused, there was a similar widening of political privileges. This was seen in the earlier days of the Roman republic. It was seen on a still larger scale in mediaeval Europe under the feudal system. In either case we had an order arranged chiefly for the benefit of the knights, who possessed the monopoly of fighting strength. Aristocratic government was an engine for keeping each man in his place in a social order of this kind. The selfish interest of the aristocracy itself formed at once the support and the danger of such an order. It was a support, because it made the government effective; it was a menace, because it ensured its perversion in favor of a single class.

The invention of gunpowder and the other changes in military tactics, which made larger armies imperative, put an end to the monopoly of power which the knights had previously enjoyed. Democracy was an almost necessary consequence of this change. The growth of democratic government, with its system of general elections, put an end to the possibility of reserving all political privileges for a single group. This is everywhere recognized. An equally important consequence, however, which is not everywhere recognized, is that it did away with much of the force which the older governments had behind them. Except in those grave crises when a wave of patriotism sweeps over the community, the support on which a democratic government relies is spasmodic and accidental. No man except the professional politician feels that the government is being run in his particular interest. On none, therefore, except the professional politician can it rely for continuous activity in giving effect to its decrees.

Yet more serious than this absence of compelling force behind a democratic government, as compared with an aristocratic or monarchical one, is the absence of continuity of policy and tenacity of purpose. A small group of men knows what it wants. It pursues common interests, and it has the power to pursue them with an unwavering fidelity. We see this advantage illustrated when we compare the diplomacy of Russia, which is managed by a few men, with the diplomacy of England, which is under the control of a great many men. The diplomacy of Russia is steady in its purpose, ready to wait when waiting is needed, quick to strike when promptness is imperative; and it is entrusted, from beginning to end, to the hands of acknowledged experts. The diplomacy of England is by contrast vacillating of purpose, impatient of necessary delays, unready in the moment of action, and handled by men who are chosen for reasons not wholly connected with fitness for their work. What is true of England in this respect is in even larger measure true of the United States. And

thus it happens that Russia, in spite of the inferior intelligence of her inhabitants and the lesser material resources at her command, is in a position to pursue diplomatic aims more surely and successfully than her rivals. If this condition shows itself in a field so restricted in its character as that of diplomacy, where the patriotism of the several countries enlists their inhabitants in a common cause, what must we expect when the same difference of method is applied to the whole field of domestic administration, whose purposes are infinitely complex, and in which the interests involved are divergent and antagonistic?

In the face of these difficulties, it is obvious that democratic government, to be successful in what it undertakes, should be managed with great caution. With the inevitable changes of purpose, due to the differing results of successive elections, it should confine its undertakings to those matters which have been thoroughly discussed and have preëminently commended themselves to the whole people. With its deficiency of physical force for carrying its decrees into effect, it should endeavor to restrict its action to those things where there is a sufficient consensus of opinion and a degree of acquiescence on the part of the minority which will render a preponderance of force unnecessary. But this caution is by no means characteristic of modern popular governments. "The new democracy," to quote the words of Lord Farrar, "is passionately benevolent, and passionately fond of power." Conscious of its honesty of purpose, it is impatient of opposition, and contemptuous of difficulties, however real. It undertakes a vast amount of regulation of economic and social life in fields where two generations ago a free government would scarce have dared to enter. In these new fields there are many instances of failure, and relatively few of success. We have had much infringement of personal liberty, with little or no corresponding benefit to the community. Prohibitory laws applied to places where there was no public sentiment behind them have proved a mockery. Anti-trust laws have

been so systematically evaded that they have degenerated into a means of blackmail; and they have often been so injudiciously drawn that their enforcement would have paralyzed the industry of the community. There is no need to continue the catalogue of appropriation and currency bills, and tax bills and labor bills, often devised with the best of intents of coercing the wicked, but ending in nothing except evasion and inconvenience.

Nor is it really possible that most of them should end otherwise. A statute passed by a majority and in the face of a reluctant minority does not represent the will of the people. It is legislation in favor of one class, which happens at the moment, through causes which may be good or bad, to control a greater number of votes at the polls, and against another class which can control a less number. Absolute majority rule, so far as it is really carried into effect, means tyrannical power in the hands of a weak and vacillating sovereign. There is a "curious political superstion," to quote the phrase of Herbert Spencer, that such rule by majorities was a fundamental theory of those men whose work at the close of the eighteenth century emancipated America and Europe from the bonds of the aristocratic system. But history gives no warrant for this belief. Rousseau himself, the father of modern democracy, is explicit in saying that the wish or vote of a majority does not necessarily represent the will of the people. The Constitution of the United States, so far from sanctioning unlimited rights of the majority against the minority, is filled from beginning to end with restrictions upon the exercise of such rights—restrictions devised in the interest of personal liberty. The Constitution indeed provides for elections to decide who shall govern us; but it in no wise encourages the intrusion of the officials thus elected into those fields of legislation where class and personal interests are arrayed one against the other.

Political aristocracy being a thing of the past, self-interest an inadequate support for political order, and over-

legislation an evil worse than that which it undertakes to cure, I believe that we have but one alternative before us if we would preserve our integrity as a nation. We must go back to the principle that a just government is based on the consent of the governed. Without that consent we have tyranny, even though the governing body possesses for the moment a majority at the polls. Without that consent we can have neither self-government nor freedom in its true sense. To maintain such freedom we must accept the principle of government by public sentiment.

This is a phrase which is often used, and almost as often ridiculed. The men who are engaged in what they call practical politics regard moral ideas in this field as a matter of slight importance, except in those rare national crises when the public is thoroughly roused. They say that for every instance of failure of legislation without public sentiment behind it you can give at least as glaring an instance of failure of public sentiment without legislative and administrative machinery to support it. They hold, in short, that government by moral ideas will not work.

I believe that this view, though widely held, rests on a misconception of what public sentiment really is.

Whenever a large number of people want a thing we hear it said that there is a public sentiment in its favor. This is not necessarily true. Even the fact that a majority may be willing to vote for a measure does not prove that it has this basis. The desire may be simply the outcome of widespread personal interest, and may not deserve in any sense the name of public sentiment or public spirit. Take the whole matter of anti-trust legislation. Most people object to trusts. Why? Largely because they do not own them. If a man really believes that a trust is a bad thing, and would refuse to countenance its pursuits if he were given a majority interest in its stock, he can fairly dignify his spirit of opposition to trusts by the title public sentiment. And it may be added that if things are done by trusts or by any other form of economic organization which

arouse this sort of disinterested opposition they speedily work their own cure. If a considerable number of influential men see the pernicious effects of a business practice sufficiently to condemn it in themselves, as well as in others, they can speedily restrict, if they cannot wholly prevent, its continuance. Most of the effective control of combinations of capital has been in fact brought about by intelligent public opinion slowly acting in this way. If, however, the critic is doing on a small scale what the trust is practicing on a large scale; if he is making every effort to sell his goods for as high prices as possible, not being over-scrupulous as to the means by which this is brought about; if he in his own way tries to monopolize the market as the ill-managed trusts monopolize theirs; if, in short, he simply complains of the practices of the trusts because he is at the wrong end of certain important transactions, and becomes their victim instead of their beneficiary, then his words count for nothing. No matter how many thousands of men there may be in his postion, their aggregate work is not likely to reach farther than the passage of a certain amount of ill-considered and inoperative legislation. Take another instance from similar ground—that of the silver movement. Here the matter was more complex. A certain amount of agitation in favor of silver was based on a real feeling that gold had appreciated, and that this produced an unfairness which was repugnant to the moral sense of the community. So far as this state of feeling existed the agitation had real strength, independent of the question whether the facts on which this feeling was based were rightly or wrongly interpreted. But at least an equally large part of the silver movement was based, not on the feeling that the exclusive use of gold hurt the public, but on the argument that it hurt certain individuals. When these individuals were therefore urged to vote for a change, not because one kind of money was better for the public than another, but because it was better for them to pay their debts in cheap money, then the silver agitation

became an appeal to class interests which could command no power except that which was represented by the votes of the class in question. This does not mean that the appeal to class interests was any less marked on the other side; but it means that even if the movement had been successful, the resulting laws would probably have been inoperative in practice, because imposed by a majority upon the transactions of a reluctant minority. It cannot be too often repeated that those opinions which a man is prepared to maintain at another's cost, but not at his own, count for little in forming the general sentiment of a community, or in producing any effective public movement. They are manifestations of vainglory, or envy, or selfishness, rather than of that public spirit which is an essential constituent in all true public opinion.

There are some moralists who would deny the possibility of any such public opinion which should be independent of selfishness, and which should rise above personal interests. But they have the facts of history against them. Aristotle has well said that man is a political animal. He has an instinct for forming communities, and for acting in concert with the fellow-members of those communities. Every such political community or unit has its code of political ethics. Under the influence of this code a man will do things which are quite independent of his personal selfishness, and which may even militate against the dictates of such selfishness. The spirit of patriotism will lead him to risk personal suffering and death itself in the service of that community; it will even lead him to submit to discipline and to restraint which is irksome in the extreme. He will acquiesce in the results of laws which place burdens upon him for the benefit of others. A community in which such patriotism and public devotion were wholly absent could no longer remain a people by itself. It would be daily threatened by conquest from without and by dissolution from within.

Public sentiment, or public spirit, is the name given to

the feeling which gives effect to these virtues. It represents each man's share in that political conscience which is as important for the ordering of the affairs of the state as is the personal conscience to the ordering of the affairs of the individual. Public opinion is a judgment formed in accordance with the dictates of this political conscience, and representing a theory which a man is prepared to apply against himself as well as against others.

Where it exists, such public opinion is not only powerful, but all-powerful. It can accomplish more than any other coercive agency in the world. Take its operation, on a small scale, as brought out in the recent hazing investigation at West Point. When the public sentiment of the cadet corps is brought into conflict with the regulations of the Academy, the unwritten code of honor proves the stronger. We may differ as to our opinion of its merits, but of its power there can be no question. And the power which is here illustrated on a small scale has been repeatedly exemplified on a large scale in the history of public and private morals. What is it that has rendered murder a rare exception instead of a frequent social event? It is not the existence of statutes which make murder a crime; it is the growth of a public opinion which makes the individual condemn himself and his friends, as well as his enemies, for indulgence in that propensity. There were laws enough against murder in Italy five hundred years ago; but these laws were practically inoperative, because they had not really formed part of the social conscience, as they have to-day. On the other hand, the social conscience of mediaeval Italy, with all its laxity in the matter of murder, was strict in certain matters of commercial trust, on which it is to-day relatively loose. A man actually forfeited self-respect by a questionable financial transaction in those days as he did not forfeit it by the murder of two or three of his best friends. As a consequence, that particular kind of financial immorality was much rarer then than it is now. Such instances can be indefinitely multiplied. Whatever may be

the dictum of the theoretical moralist, no student of social order will doubt that public sentiment, if once aroused, can be made to dominate the action of individuals and lead them to do things which, from the standpoint of selfishness, are inconvenient and irrational.

But can public sentiment be thus aroused to do any large portion of the work which we now demand of government? Admitting its power in those cases where it already exists, can its application be widened at will, so as to reach those financial and social wrongs in which the pursuit of self-interest has involved us? This is a fair question, which must be fairly answered.

It may be frankly recognized that it will not do all those things for which numbers of people now desire legislation. This fact, however, can be considered a merit rather than a fault. If any agency were found to give effect to all the ill-considered demands of our majorities, there would be no more freedom in America than there is in China. That it can be made broad enough to cover the field where legislation has proved practical and salutary is, I think, scarcely open to doubt. One or two instances will help to illustrate this. The history of liquor laws shows that the attempt to enforce prohibition on all localities indiscriminately, independent of the public sentiment which lay behind them, resulted not only in defiance of this law, but in degradation of the authority of the State itself; and that the really effective control was accomplished by statutes so framed that public action went hand in hand with public opinion. The history of railroad legislation in the United States furnishes even more marked instances of the same sort. It has been a pretty constant record of the success of measures which undertook little, but provided for much publicity, as compared with measures which undertook much, but tended to drive the recusants into the dark. If this has been the case hitherto, when the development of public opinion has been treated as a mere accident, how much more may we expect it to prove true if the principle

were once brought home to the citizens as a body that public sentiment was the important thing on which to rely, and that they could not afford to devolve upon the legislature or the administration a responsibility which must finally come home to themselves. That the better class of American citizens would refuse to accept this responsibility, when thus squarely brought home to them, I do not for one moment believe. In the matter of personal morality they do in fact accept it. In no nation is the influence of sympathy for others so powerful; in none are the strong so ready to sacrifice their convenience to the comfort of the weak. That these methods are not carried out in our business and our politics is, I believe, due to false theories of government, accepted by the community as a whole, which lead men to rely too much on self-interest and on legislation. If our people can accept cheerfully those burdens involved in the duties of private life, there is no inherent reason why they should fail to accept the trusts of public life. That they are now inclined to make light of their obligations to others, in business and in politics, is not due to any incapacity for taking such obligations seriously; it is due to the fact that they have been taught to regard business and politics as games, with no obligations profounder than the rules and no authority higher than the umpire. It is this inadequate conception of public responsibility, rather than any reluctance to sacrifice themselves where a responsibility is recognized, that now stands in the way of our progress.

What rules of conduct public opinion would prescribe in order to meet the political and industrial dangers under which we suffer, it is too early to say. What specific obligations the public conscience, when once aroused, would regard as binding in matters like this, we have no time to consider at present. It would take not one hour, but many, to discuss the uses which could be made of such a power, when once fully recognized as a working force in political life. It is enough for the moment to call attention

to the fact that this power exists; that it is an instrument fitted to meet the most urgent wants of society to-day—strong where strength is needed, slow where conservatism is required, capable of indefinite expansion without threatening the foundations of self-government. It lies for the time unused; but it waits only the mind which shall discern its possibilities and the hand which shall wield it in the public interest. To the men who will thus see it and use it it offers the opportunity to become leaders in a higher type of social order than any which the world has yet seen —an order in which the principle of *noblesse oblige* is recognized, not as the exclusive glory of one class, but as a democratic possession which imposes its honorable burdens upon the whole body of the people.

The question is often asked what constitutes the essential mark of a gentleman, as distinct from the accidents of birth and of clothes, of manners and of speech. I believe it is to be found in the readiness to accept trusts, even when they are personally disadvantageous—the readiness to subordinate a man's own convenience and desires to a social code. The code may be a good one or a bad one; but it is an authority which the gentleman accepts of his own free will, without waiting for any one to compel him to accept it. To the extent that he does this, he not only proves himself a gentleman, but proves himself capable of self-government. In this sense I believe that the great body of the American people are gentlemen, and are therefore capable of self-government. There is much which is as yet defective in our commercial and political code of honor. But the fundamental fault is in the code and not in the man; and therefore the task of the reformer is no insuperable one.

The thing that makes democracy practicable is a willingness on the part of the mass of the people to submit to self-imposed authority without waiting for the policeman to enforce it. The cause of democracy was, as we have seen, the distribution of fighting power, which formerly had been confined to one class. The possibility of main-

taining democracy is due to the fact that the readiness to accept self-imposed burdens has gone hand in hand with the distribution of power. The danger of democracy lies in the adoption of a false code of honor, which tolerates and approves the pursuit of self-interest in lines where it must prove ultimately destructive to the community. If our men of influence can see these dangers in time to submit to self-imposed restrictions, they can preserve their freedom from legislative interference, and our republic can remain, as it now is, a self-governing body. If they do not see it in time, the demands for the extension of legislative machinery and police activity will so far restrict our personal liberty that democratic freedom will exist only in name, and we shall have a social order where the form of an occasional election is but a decent veil to disguise struggles for the tyranny of one class over another.

It is for the young men who are coming on the field of political life to-day to guard against this danger. You, as college students, have lived in a community which has its historic traditions and its collective aspirations; which is in a true sense a body politic, with its public spirit and its public sentiment. It is for you to carry into the larger world of business and of legislation the spirit which will subordinate personal convenience to collective honor. Cease to appeal exclusively to self-interest, either in your own judgment or in the judgment of others. For a political leader who not only has fixed standards of right, but a belief in the capacity of the people to accept those standards, the times are always ready. Calhoun and Clay and Webster and Lincoln differed in their judgments and in their conclusions. But it was characteristic of them all that they made their final appeal, not to the narrow interests of any class, but to what they believed to be broad principles of public opinion and public morality. It was in the spirit of these men that our republic gained its growth during the century that is past; it is for us, their sons, to see that the same spirit is applied to the yet larger problems of the century which is to come.

SOMETHING ABOUT THE SCIENCE AND THE ART OF SHIPBUILDING.*

By GEO. W. DICKIE.

I.

I do not expect, and I trust that none of those who have come to hear what I have to say on the art of shipbuilding will expect, that much can be done even with the beginnings of such a subject in two short lectures. If I succeed in presenting such an outline of this great art as will attract the attention of either teacher or student to the importance that this subject may assume in the future history of this State, I shall be fully satisfied with such a result as a recompense for the time spent in preparing these lectures, which can only touch the fringe of such a vast subject.

For the past year or two there has been a gradual awakening of the people of this country to the importance of naval power, both commercial and military, to the future prosperity and stability of the United States. The importance of a great ocean-borne commerce that will equal the industrial capacity of the nation, is to be, I think, the dominant question with the men of affairs during the next years of industrial history in the United States, and in order to make that growing sentiment effective, every great

*Two lectures to the students of the College of Commerce, February, 1901.

university, especially those that provide the means of education in our seaboard states, should be thoroughly equipped to teach all that is teachable at a university of modern naval architecture.

With the compounding of the steam engine, and surface condensation, coupled with the new material of construction, first iron and later steel, all within my own experience as an engineer and shipbuilder, and the great modern necessity of speed, came the imperative demand for new forms, new dimensions, and new principles, necessitating a new science, now called the modern system of naval architecture, embodying within it the needs, the machine tools of the marine engineer, and requiring for its full development that we should ransack all the accumulated knowledge of modern science, all the refinements of mechanical skill, and all the education that universities, schools, and books can bestow.

Modern naval architecture is therefore a new science; modern shipbuilding is a new art, working new materials; and a modern ship is a new creature born of that science and art, animated by the breath of steam, guided in its course by navigators, driven by engineers, steered by hydraulic power, or by steam, or if just out, by electric energy; ballasted by water, worked and pumped by steam power, ventilated by electric blowers. If a warship, carrying guns each as heavy as a modern locomotive, so that they can be trained only on a turn-table operated by electric motors.

Wood has almost disappeared from the modern ship, for even the steel decks of our modern ships are not always carpeted with wood. Hard, tough, tempered steel thickens the sides of the warship against shot and shell. The telephone conveys the volition of the controlling mind from stem to stern, and from the magazines below to the military tops above. Counting machines in the engine rooms keep the ship's reckoning, and recording logs her rate of progress through the water. In size the length of our modern

ship lays the ordinary sea by spanning the crests of the waves, and her height out of water places her passengers, that is the first class ones, above the breaking sea.

We have about reached the time when every voyage connecting one country with another is performed by ships built for the exact purpose of that trade, and so fitted in size and character to the special duty they are to perform that their work on the high seas is performed with as much regularity, as little risk, and at as little or less cost as by the most economical and regular of modern railways on land. And so the time has come that some of the boldest men of science in the first half of the century just closed thought within the possibilities, when those who had a little time and more than a little money would no longer have to go out of this world ignorant of the beauty and the kindliness and the helpfulness of so many of the fertile, lovely, and teeming countries God has made and peopled, and adorned and blessed with countless food and wealth; but that those favored ones will be able to take with them when they leave this world a clear knowledge, a kindly recollection, a grateful experience of its varied climates, of the wide scope of human kindness, of the boundless blessings that come of mutual human help, and of the astounding wealth of all the blessings of human life, which in this world have been provided and stored up for those who have heart enough to do what is necessary to possess them.

I suppose you will be thinking that I am drifting into a discourse on the humanities of shipbuilding, but you need not fear any such result; it is only my way of edging up to my subject, looking for a weak spot where I might safely make an attack.

The new conditions of modern commerce are continually bringing new problems before the naval architect that the modern ship must solve. The way of an old ship was to rise over the waves. The way of the modern ship is to go through them. The way of the old ship was to take the sea easily, to ride well at her anchors in a storm; to lie to when

it blew hard, and to scud away before the wind when it was found most prudent to do so. The modern ship must have above all one quality; before all things she must be fast, easy through the water, but not easy on it. She must never have to lie to; never have to anchor, except in harbor at the end of her voyage. Straight from one port to another must be her path across the seas.

To meet this desirable quality many hard conditions must be reckoned with, for with it must be combined other desirable qualities that are very difficult to unite. Speed is most desirable in a modern ship, but with it must be united seaworthiness, durability, and economy; and under these a number of minor requisites, which the peculiar trade conditions for each ship prescribes and which her structure must fulfill.

The sciences that enable the naval architect to deal with these several and great problems are: how to make a ship float; how to make her carry a cargo; how to make her stand upright, when certain forces try to upset her; how to make her obedient to the will of her commander; and how, in addition to all these, to make her go easily through the water.

With these prime factors come the following problems: how to give a ship a given draft of water and no more, first when she is light, and second when she is laden; how, with the given draft of water, to prevent her oversetting when she is light and rises high out of the water, and how to prevent her being overturned by the great load laid in her when heavily laden; how, when the waves roll up on one side of her, to prevent them going over into her without at the same time heeling her so far over as to meet danger on the other side; how to make her rise to the sea forward so that the waves may not flood her decks, without at the same time, making her rise too far, inducing a plunge into the succeeding hollow, making her uneasy and slow; how so to form her stern that when running before a sea it shall not break over and poop her; if a sailing ship, how to

make her so stiff on the water that the wind pressure on her sails shall not upset her, without at the same time giving her so much stiffness as to carry away her masts by the jerk of the sea; how to make her turn around quickly and in short space, in obedience to her rudder, however fast she may be going, and how to prevent her going the way the the wind blows, except under the direction of her rudder; how, in combination with all the foregoing, to make her fast before the wind, fast against the wind, fast across the wind, fast when deeply laden, fast when light, fast when the sea is smooth, and fast when the sea is rough.

These are some of the problems with which the science of naval architecture must cope. They are all matters, the principles of which belong to pure science. They are all matters of forethought and calculation, for which exact results are to be sought and ascertained long before the shipbuilder can even set about his work. They form the science of naval architecture, as distinguished from the art of shipbuilding. And as they must be thoroughly understood by the designer of modern ships, I propose in this lecture to try to make plain to you how they are applied in ship design, and in doing so I can only touch upon the more important features of ship design, and in their simplest application. And I will endeavor to follow in this the order given.

The first two problems named, how to make a ship float and carry çargo, may be termed the foundation problem for the naval architect to solve.

The first question that the naval architect must settle in beginning the design for any given ship is the same question that the architect of a building must first settle, that of foundation. The size and weight of the building, with its contents, determine the character and extent of the foundations required. So the size and weight of the ship, with its load, determine, not the character of the foundation, for that is always the same, but the amount of foundation.

The naval architect calls his foundation displacement, and his unit of measurement for it is thirty-five cube feet, because that volume of sea water weighs one long ton. The law that governs the floating of the ship and what she can carry, is said to have been discovered by Archimedes. He is the man who said "Give me a lever long enough, and a prop to place it, and I will move the world." But he said something else of far more consequence to the shipbuilder: "Give me a weight, however great, and I will float it." This is the wonderful discovery which he is said one day to have made while taking his bath, when in his joy he so far forgot himself as to rush out shouting "I have found it! I have found it!"

He is therefore the father of naval architecture as a science, and in order to understand how to make a ship float, we must understand his great law of displacement.

Perhaps the best way to understand it is to study it as he did, by means of a bath. Take a bath tub six feet long, two feet wide, and three feet deep, and fill it two feet deep with water. Mark where the water stands in the bath, and get into it, letting yourself sink in the water until nothing but a portion of your face floats above. Now if I were you your weight would be 188 pounds, and you would find the water rise in the bath exactly three inches. I need not tell you that the rising of the water in the bath was caused by your body displacing it from the lower part of the bath which it previously filled, causing it to rise into the higher part. In short, by so much as the bulk of your body has put into it, by so much has the water been pushed out, displaced, and raised. If you could measure the exact bulk of your body immersed, and measure the exact bulk of the water raised, you would find them identical, bulk for bulk; and what is strange, but not obvious, is that they are also equal weight for weight. It was this that astonished Archimedes.

The principle of displacement consists therefore of two parts; first that a body placed under water displaces as

much water as its own bulk; second that it floats when it weighs less than the water it displaces.

To illustrate how this displacement of water, bulk for bulk, and weight for weight, forms a perfect and sure foundation for a ship, let us take for example a warship, say the battleship Oregon. The very first thing the designer had to decide was, how deep shall my foundation be? The depth of certain docks and harbors must be considered in reaching a decision, and knowing where the vessel had to go, this was fixed for the normal weight of the ship at twenty-four feet. This depth of foundation must therefore carry the structure with its normal load he is to build.

Having this important point settled, he must now get information from other experts. So he calls upon the engineer for the weight of all the machinery, the boilers and the water in them, that the foundation must carry for him. He calls upon the ordnance expert for the weight of all the armor, guns, and ammunition the foundation must carry for him. He calls upon the equipment expert for the weight of all the outfit, coal, and stores the foundation must carry for him. And then he figures out very carefully the weight of the structure itself, to be added to the weights furnished by the other experts, and the result is that the foundation must carry 10,400 tons.

He must now consider how wide his foundation will be. The position of the center of gravity of the weights that he has to carry above the base line of the foundation helps him to determine this dimension. Here he also consults all the gathered experience of his profession, with the type of ship nearest to the proposed design, the result being that he decides on a width of 69 feet.

Now if he was to build simply a rectangular structure, the weight of which was 10,400 tons, he would find that at 35 cube feet to the ton, the cubic contents of the foundation would be 364,000 cube feet, the depth having been settled at 24 feet, and the width at 69 feet; the length would therefore be 220 feet.

This would be the smallest dimension of foundation that would carry the load, and is called the box displacement; that is, a box 220 feet long, 69 feet wide, and 24 feet deep, if filled completely full, would contain 10,400 tons of sea water, the exact weight of the battleship and the exact bulk of that part of her that is below the surface of the water, although not the form possessed by the under-water body of the vessel.

Here a great many considerations present themselves in regard to form. The naval architect knows that to add to the length would give him fine lines, and speed with moderate power, but would detract from other qualities that a battleship should possess; and speed, though very desirable, is not everything. So again he has recourse to experience, and this tells him that the difference between his battleship and a rectangular box must be somewhere between .6 and .65. So he decides upon .631, and this makes the length of the battleship 348 feet.

This proportion that the part of the ship that is in the water bears to a rectangular box is called in America the box co-efficient, and in Great Britain the co-efficient of fineness.

On this foundation of displacement floats our battleship, or any other ship we may design, and it is absolutely sure if the weights are correct. But if the weights to be carried exceed by any amount the designer's figures, the foundation gives way correspondingly.

The designer therefore must be sure of his weights, and of his dimensions, and his co-efficient of fineness, or his foundation will fail him. His ship will displace not an ounce more than her own immersed bulk.

The volume of water she displaces is said to represent the floating power of the ship. It really represents the buoyant power of the water acting on the outside of the ship. The ship itself has no power to carry anything, or to float. All it does is to exclude the water, and enclose the cargo. The ship is merely passive. The water carries both the ship and her cargo.

Buoyancy is therefore the power of the water to carry a given ship, and its power is exactly as the bulk of the body of the ship under water, and its force is measured by the weight of the water displaced, which we call the ship's displacement.

There is a very important conclusion to be drawn from this law discovered by Archimedes, and it is this: that the floating power of a ship has nothing to do with her shape, but is entirely due to her size or bulk in the water.

Practical shipbuilders of the old school, ignorant of the laws of naval architecture, have imagined that they could confer surprising powers of flotation and ability to carry heavy weights, merely by giving proper shapes devised by themselves to the immersed bodies of their ships. Some of them, of considerable eminence, passed long periods of their lives under this delusion, and a very distinguished one wrote a book on the subject; but the delusion passed away, and the authority of old Archimedes was established.

The fact, however, that practical men for long thought that form had something to do with buoyancy, shows that the principle of flotation is by no means self-evident, and that its discovery by Archimedes had great merit. Its great value to us is its admirable simplicity, its unquestionable authority, and its absolute exactness. To understand its nature is, however, less easy than to appreciate its value, and it will take a great deal of thought to understand thoroughly why no possible invention of shape can give to a ship the power of greater or less buoyancy than is measured by the exact weight of water which forms its displacement.

Form, however, has much to do with other qualities that a good ship must possess. For the naval architect, having determined the amount of foundation, that is displacement, that will carry his ship and her load or cargo, must now deal with another quality—that of stability, or the power of water to make a ship stand upright.

Here a complicated set of problems confronts the

designer. In a building the more stability the architect can secure the better, but in a ship there is always a desirable amount of stability required, and too much would be quite as undesirable as too little. It is therefore the business of the naval architect so to work out his design that the proper amount of stability will be attained.

That we should ask of the most unstable of elements to confer stability or give uprightness to heavy bodies raised to a great height above its surface, would appear to be an unreasonable expectation, did we not see it accomplished every day.

One might imagine at first sight that the upward pressure of water on the bottom of the ship should help to give uprightness to the structure it upholds from below. But this thought will not stand examination. To push the bottom of a thing upwards may be simply trying to upset it. What we want is to keep the top up and the bottom down. How, out of these contradictory elements, to elicit stability is neither an obvious nor an easy investigation, for it is certain that the upward pressure of water on the bottom of a ship, instead of being a cause of stability, is a powerful agent of instability, and that the greater it is in quantity, and the more effectual in power, the more it tends to upset the floating body, and this truth must be thoroughly mastered by the naval architect.

Stability and steadiness do not always go together in a ship; in fact, they are sometimes quite opposite qualities. Stability must be present to secure steadiness, yet a ship may have a large amount of stability, and notwithstanding, in fact because of, extra stability, may be a very unsteady ship.

It will not be possible for me to take you into all the problems involved in securing, under all conditions, the proper amount of stability for a given ship, as that usually forms the subject for a whole session in a college of naval architecture.

In short, the stability of any ship under any condition

of load depends upon the relative position to each other of two points; the one is the center of movement of the mass, and the other is the center of weight of the mass. The naval architect calls one the metacenter, and the other the center of gravity. And he expresses the stability of his ship by the sign of an M above a G, and the amount of it he expresses in feet and inches.

The metacenter is the point around which the ship moves in rolling. There is, of course, also a longitudinal metacenter, the center of motion in pitching, but it has nothing to do with stability. It is the transverse metacenter that we must be most careful about. The naval architect finds it by taking the center of buoyancy of all the sections he has made of his ship at a given draught of water, and therefrom finding a mean center of buoyancy. The metacenter will always lie in a longitudinal vertical plane, bisecting the ship, and on any inclination will be on that plane virtually over the mean center of buoyancy. It is where the line of upward pressure passes through the vertical plane of the ship as stated, and its power is obtained by dividing the moment of inertia of the water plane relative to the middle of the ship by the volume of displacement.

This of course you cannot understand from what I have stated, unless you have made it the subject of extended study, and for the present you will have to take my word for it.

The commander of a ship may not know how to find this important point in his ship, but the way she behaves herself at sea will soon enable him to determine whether it is in the right place or not.

Then the center of gravity must be carefully determined, both for the ship and her contents, by the designer, and to do this he draws a line under the keel, and this he calls the base line, and, having found the metacenter, he notes it as so many feet and inches above the base line.

Now he begins a series of computations in regard to the

weight of every part of the ship, and whatever she has to carry under the conditions he is figuring her for. Nothing must be left out. He also finds the center of gravity of every piece, and its height above the base line. He expresses the weight of every piece in tons, and its height above the base line in feet. He multiplies these two factors by each other, and expresses the result in foot tons; and this is termed the moment of leverage of that particular piece.

Having thus determined the weight and leverage of every part of the ship, and whatever she is to carry, the total moment or foot tons divided by the displacement or foundation weight will give you the height of the center of gravity above the base line.

You may not understand this, and for my present purpose it may not be necessary, but the naval architect must understand it very thoroughly, or the result might be very serious indeed.

The stability, then, of any ship depends upon how much M is above G in her design. If they were both in one place there would be no initial stability, and the ship would just remain in any position that she might accidentally get into. And if G were above M she would turn bottom side up.

This initial stability is an inherent quality in the design of the ship. It may be modified after the ship is built by placing weights below if G is too high, or by placing weights above it if it is too low. But this always reflects on the skill of the designer.

Through ignorance of the laws that govern the stability of a ship, those in charge of her often stow weights on board in such a position as to endanger her stability. A ship may have a large amount of initial stability, and yet be very unsteady at sea.

If the ship were intended for river or harbor navigation, and would never encounter rough weather, then the more stability the better. But when amid waves, if the metacenter be too far above the center of gravity, the tendency

to assume an upright position may be too great, and violent rolling may be the result.

The naval architect must therefore test the design for the ship he proposes to build to see if her righting moment is sufficient and not too great.

The change of form at the water plane or surface of the water as she heels to either side is the great factor in determining this quality of a ship. He finds that when he heels or inclines the various sections of his design relative to the normal water plane, that on the one side a wedge-shaped piece goes down into the water, while another wedge-shaped piece comes out of the water on the other side. These two wedges are called the wedge of immersion and the wedge of emersion. Now if these two wedges were both alike, the ship when thrown out of the upright position by the waves would not come back again. But if the wedge that goes in is greater than the wedge that comes out, the difference is called the righting moment or power of shoulder, and if this is very great, the ship, when thrown out of the upright position by waves, would come back too quickly and would have an unsteady and violent rolling motion in a sea way. So the skillful architect will modify his sections about the normal water-line, so that the wedge going in will not be too much in excess of that coming out, and thus secure easy motion in rough water.

This question of steadiness receives careful attention in the designs for a war ship, because the weights to be carried are all known, and their positions fixed in the design. The water-line is also known, and changes only with the consumption of fuel and stores.

But in a merchant ship the designer has not so full control over the quality of steadiness, as a great range must be provided for in the position of the water-line, and consequently much of the steadiness at sea of such a ship depends upon a proper distribution of the cargo.

Along with initial stability and steadiness in rough water, the naval architect must so design his ship as to

secure great range of stability; that is, he must maintain a righting moment sufficient to bring his ship back again, should she by some unusual force or combination of forces be forced far out of the upright position, and he generally constructs a curve or diagram that shows how far his ship can roll and yet retain the power to recover her normal position. This is called her range of stability.

These are only some of the questions pertaining to the hydraulic and statical qualities that a ship must possess to be successful. Many compromises must be made amongst the contending forces by the skillful designer to get the best mean good result possible. Knowledge must go with skill and experience in solving the many problems involved in the production of a modern ship.

I have tried as briefly as possible to explain how a ship is made to float and carry a cargo; how she is made to stand upright; and how she is made steady. To serve the purpose for which she is designed, that of moving herself and cargo from one port to another with more or less speed according to her design, the naval architect must determine the power that will be necessary to produce the desired result.

Is there any reason why one ship should be more easily pushed, or pulled, or drawn, or driven through the water than another? The weight of a ship being water-borne is not an impediment to speed; but weight is in the case of a ship inevitably joined to bulk. Every ton of a ship's weight occupies thirty-five cube feet of room in the water. To drive a heavier ship through the water is therefore to drive a bulkier ship. It is easy to fancy that in making room for a larger ship we may have more work to do than in making room for a smaller one; but on further consideration it will not seem quite certain that the mere change of place should require expenditure of force. Once in the water and occupying a certain bulk or room in the water, why should there be anything to prevent the ship changing her place except the mere momentum required to start her?

There is no reason why she should not occupy one space in the water as well as another, unless there be something in the nature of the water itself to hinder her. If the water have no objection to make room for the ship to move, there is no reason why the ship should not change her place. But it was early discovered that the water does offer a very decided opposition to a ship's change of place; and in order to measure that opposition the naval architect must understand the way of a ship through the water.

A ship floats by being entirely supported by the water pressing it equally on all sides, and not more one way than another, and, these pressures being all balanced, the ship stands still.

If I want this ship to move ahead, I must do one of two things; either open up a passage that way, by making a hole in the water into which the ship may go, or push the ship so hard from behind that she herself may form the instrument for pushing the water out of her way.

This seems very simple, but it involves the most intricate problems in naval architecture; for, whether it be by scooping before or pushing behind, the water occupying the place to which the ship is going must be removed. If it were possible to dig out a trench in the water and keep it clear, the ship would go on, having only the resistance due to the friction of the water on her skin, or what is called skin resistance. But the ship must dig its own trench, and the difficulty is to know what to do with the stuff that has to be removed. The ship cannot advance a foot without taking out a foot of stuff for every sectional foot of the passage required. How is the ship to dispose of this stuff, where is it to lay it? That is the difficulty, for herein lies the cause of the main part of the resistance the ship experiences.

It would be impossible for me to go into the problems that confront the naval architect in his efforts to find a form of least resistance for his ship that will leave him the necessary bulk to carry the ship and her cargo on dimensions that will be the most economical to build. At present the

law of comparison based on tank experiments with models of various forms, coupled with his experience based on the performance of actual ships, is what he depends upon to guide him in new designs.

Briefly, the water resists because it cannot get out of the way of the ship; for where it is not pressed by the ship it is on all sides pressed by other water as hard pressed as itself. It cannot escape downwards, for that is full of water, and so it is heaped up in front of the ship, and it is this head of water in front that is at once the cause and measure of resistance. This resistance to the progress of the ship has been carefully measured. If the ship were square ended, it is accurately known. The height of this piled-up water depends on the speed, and is proportional, not to the speed only, but to the square of the speed. At a speed of 8 feet per second it would be 12 inches high, and its resistance would be 64 pounds on each square foot of the ship's section.

It may be taken as one of the best-established laws of mechanics that the direct head resistance of water to a flat-fronted body making way through it is measured by the weight of the head of water raised above the level of still water, and that this weight is 64 pounds in salt water at a speed of 8 feet per second. But the height of this head of water or bow-wave varies as the square of the speed, being 1 foot at 8 feet per second, 4 feet at 16 feet, 9 feet at 24 feet, and 16 feet at 32 feet per second, or 20 miles per hour.

Speed, therefore, is an element in the resistance of a ship as well as size, and how to open up a passage for the ship without raising the water as high in front as the speed with a square end would do, is the problem set before the naval architect. If the science dealing with fluid resistance could furnish him with a true measure of resistance for every conceivable form between a square end and the finest wave-line, he could not miss that of least resistance for the bulk he wants to drive through the water at a given

speed. Much has been written on this subject, yet we are still testing varied forms. The reducing of one form of resistance often increases another form, and then least resistance must always be coupled with other conditions of load-carrying power. This has led to increasing the dimension of length as compared with cross-section, thereby increasing the power to carry without increasing the end resistance, the opposition to end motion being increased only by that due to skin resistance.

The great problem of getting a great ship easily through the water, in its simplest form, is this: How can I remove the water which lies on a ship's way, out of it? How can I remove it fastest? How slowest? How with the least force? How can I remove just as much as is necessary, and no more? Where shall I put it so as to lie most completely out of the way? And how shall I economize the movement so that not a particle is carried further than is necessary? In short, how can I do this work without wasting any of the power, either of steam or wind, that I use to propel my ship?

There is a great field yet left for future naval architects to explore. Many able men are at work on the problems involved in how to give a ship that form which may be pushed along the surface of the water fastest, with least expenditure of power, or, rather, with no waste of power. Men have been seeking to discover a solid form of least resistance. This phrase expresses the conviction in the minds of those who use it that there is some shape of ship, some form of solid body, which when afloat would not be opposed by the water so much as some other forms. Which also means that there is for water an easiest way of moving or being moved.

These questions lie at the root of the science of shipbuilding. I have only been able to hint at some of the main problems that confront the naval architect in this lecture. Much is being done in these days towards a more extended and accurate knowledge in regard to them. All

seaboard states aiming to become shipbuilding centers will have to provide the means for their sons to acquire this knowledge, in order properly to equip them for working out further advances in this great science.

For this State, bordered as it is by that ocean which, unless all indications fail, is to be the stage of vast developments in ocean-borne commerce, no provision for instruction in science that can immediately be applied to the development of a great industry is more needed now than a college of naval architecture.

If I have been fortunate enough to interest my hearers to-day in this study, I shall consider this afternoon well spent, and hope that in presenting in my next lecture something on the art by which the shipbuilder puts into shipshape form the design of the naval architect, I may be fortunate enough to increase your interest in a subject that must in the future be one of the branches taught in our State University.

II.

In a former lecture I tried to show you some of the great problems that the naval architect had to solve in the design of a ship that would meet the requirements that he had in mind when preparing his design. We were able only to glance at the most important factors in ship design. How these factors were applied in special cases, and the many conflicting elements that of necessity enter into every design for a ship, even of the most simple type, were matters that the small compass of one lecture would not permit our even naming.

Yet I trust that what was then said may have led some of those who listened to me into further thought on the science of shipbuilding, as the subject presents a vast field of inquiry for the student that will richly reward the right kind of study.

In this lecture I desire to say something on the shipbuilder's art, as distinguished from the science of shipbuilding.

The work of the shipbuilder is divided from that of the naval architect by the same line which separates the profession of the civil architect from that of the constructor of the building. The one has to do with the original intention, invention, and inspiration; the other has to do with giving the design practical form, the assemblage of fitting materials, the process of giving them proper shape, and the details of putting them in place and securing them there.

The science of shipbuilding requires calculation and headwork as its business, as distinguished from the handiwork, which requires mainly skill in the use of tools, but which, nevertheless, cannot dispense with headwork.

The naval architect must do his work before the shipbuilder begins his. He has settled, fixed, and measured all uses and purposes of the ship; he has balanced the opposing forces against each other; he has decided to what extent each desired purpose shall be effected, and each desire on the part of the owner fulfilled. He has, in fact, laid down "the law" of the ship. He also shows in his design how "the law" is to be executed. The ship is meant to be so fast, and therefore must be of this length. She is to be so roomy, and therefore must be so deep. She is to have so much stability, and therefore must be so wide. She is to carry heavy weights, she must therefore have a high box coefficient. She must be easy and seaworthy, and therefore so shaped. She will have heavy cargo one way and light the other, so she must have water ballast. She must be with all sightly and convenient, and so must have a graceful outline. If a sailing ship, she must be weatherly, and must therefore have so much hold of the water, must be of a certain rig, must carry certain sails which must balance well, and she must carry them bravely in all weathers.

All this the naval architect must lay down in law, and also in lines—lines so exact and well thought out that any deviation therefrom would detract from the character of the ship.

All these wise provisions of the naval architect it is the business of the shipbuilder truly and faithfully to execute. As in the naval architect the highest quality is science and judgment to apply it, so in the shipbuilder the highest quality is craft and skill, and if combined in one person, so much the better will the result be. The builder has to deal, not with thought, but with matter; not with opinion, but with weight and strength. He has not to battle with figures and calculations, but to wrestle with rough, strong, obstinate matter; to twist and mould, and hammer and hew to his mind; and that which the naval architect had to do on paper, he has to do in steel or iron and wood.

The business of the shipbuilder is multifarious, far spread, and heterogeneous, and he must set about it in this wise: having studied out what sort of a ship it is to be, his first duty is to find the materials out of which the ship is to be built.

In by-gone days when ships were built of wood, and still where that material is used, he himself would go on toilsome journeys into the oak forests, and there with the forester select the timber fittest for his purpose, have it felled, and in due time brought home to his yard. In order to do this wisely it was no mean part of his skill to carry about with him in his head the various shapes and curves required for every timber in a ship; and to fit these into the live trees with his experienced eye was no mean achievement of craft and skill.

I have, when a boy, gone to the woods with my father, who had considerable skill in buying standing timber, not only for his own yard, but for other yards that would get him to buy for them also. "Here," he would say, "mark this oak. That is a stem; its crooked neighbors would go with it for a forefoot; yonder straight one will be a grand stern post; here are four fine elms for the keel, and these others will plank the bottom. Here is a fine lot of oaks for floors, and that lot of crooks will come in for first and and second foottocks." And so he would go on through all

the requirements for framing a ship of the old time; and on the skill of the builder in those days in this respect, much of the durability of his work, his own profit or loss, advantage or ruin, naturally depended. Skill to know good from bad; skill to select quality of timber; that was a first requisite in a builder of my father's time.

Since the time when I went to the forest with my father selecting timbers for the Baltic traders he built, a revolution has taken place, from the natural, traditional, and universal practice of building ships out of wood taken from the trees of the forest, to building them of metal dug from the bowels of the earth. To build ships of wood seems natural, and therefore right. But to build ships of iron or steel was in the nature of things preposterous, unnatural, and absurd. "I'll never build an iron ship; it's against nature," was an expression often used by my father; and he never did.

The real difficulty was, not how to make iron float and carry weights, but how to build it strong enough to endure the straining and racking due to heavy seas. Any tinker could build an iron vessel thin enough to swim; but it was soon discovered that special skill was required to make it strong and durable. The first ships built of iron taught the lesson that it was easy to make iron ships to swim and carry, and that it was only hard to make them strong and seaworthy. The first experiments in iron shipbuilding enabled the builders to discover that there was much more to learn than merely making an iron box, shaped like a ship, thin enough to float, and large enough to carry.

It soon became obvious that the problem of building good iron or steel ships was one of a much higher order: that it required skill in the nature of iron; skill in the strains to which such structures are subject; skill in the shapes which make iron or steel capable of bearing one strain or another; skill in the properties of the various parts or members of the structure, so that they may best combine to help one another in bearing the strain; skill in

the methods of fastening one piece of iron or steel to another, so that the means of fastening shall give strength instead of diminishing it. And then most careful study was necessary of all the compound strains, which in a heavy sea test the structure and threaten its destruction. For this complicated structure of iron or steel may have its two ends supported on two waves, and the middle left comparatively without support; while on the contrary, it may be hung up in the middle by a single wave, leaving its two ends in the air, with all the variations possible to these hogging or sagging strains, and applied at all angles.

These were conditions in which it was supposed that the timbers of a wooden ship would have much more flexibility than the material of an iron or steel one, and that by yielding it would give and take a strain much more kindly. So the general safety of a large iron or steel ship in a storm appeared to present an entirely new form of mechanical problem, requiring for its solution a kind of skill, both high in degree and comparatively rare.

At first the skill required for the proper design of an iron or steel ship was a rare thing, because of the total want of precedent for iron structures and sea-going ships. At first the wooden shipbuilder was depended upon for the proper proportions of the parts in iron ships. Unluckily, the wooden shipbuilder as a rule hated iron ships, and but little help came from that quarter. Those who did try knew little or nothing of working iron plates and shapes, or the right strength or proportions to give them or the right way to fashion them.

The men who did know something of the qualities and properties of iron and how to shape it, belonged to quite another race, occupied in thinking of quite other things. The smith and carpenter had little knowledge in common between them. There was also a race of iron boilermakers, who were known to understand how plates of iron could be cut and bent and shaped, and joined to one another. There was therefore some help in the way of workmanship that

came from them, but as to general design, large mechanical principles and skill, enlightened by science, there was no race except the civil and mechanical engineers who had acquired much skill in using iron, and from them a considerable amount of skill of the right sort was available when the necessities of iron shipbuilding required it. Thus the new art and science of building ships in iron and steel was worked out mainly by mechanical engineers.

Thus it came about that iron shipbuilding was taken up principally by engineers who made one part of their business the manufacture of marine engines to drive ships, and the other part the manufacture of the iron ships they were to drive. In this natural way it came about also that iron ships and their engines came to be designed by one and the same person, and this was found so convenient that at the present day most iron shipbuilders build their own engines and many engineers build their own ships.

There is also another point which more clearly identifies iron or steel shipbuilding with engineering than wooden shipbuilding, namely, that the machinery, plant, and establishment required for the building of iron or steel ships are very much the same as those required for engineering, the materials used being nearly the same also. It is necessary, therefore, for the iron or steel shipbuilder to be skilled, not only in the quality and uses of the material he works with, but also in the employment and application of all the engines and machinery which are required to work it into the shape of a ship. He must work with presses to produce complicated shapes; rolls to form part of curves; rolls to straighten; planing machines to edge and butt his plates; beveling machines to open or close his angles for frames; scarping machines, punching and shearing machines, drilling machines, furnaces, and all the bending tools that go with them. And now a large proportion of the riveting is done by machine. The modern shipbuilder, therefore, will do well to fortify himself by an apprenticeship in an engineering works. If he has gone through a course of training

in wooden shipbuilding, so much the better, for there is still much to be done common to both.

To sum up the kind of training necessary to form a complete and well-equipped modern shipbuilder, I venture to suggest that he should first make himself by study a good mathematician, a good mechanic, and a good theoretical naval architect. Next, that he should serve some part of his time as apprentice to a mechanical engineer. Next, that he should study the nature, manufacture, qualities, and prices of materials used in shipbuilding; and while he is doing all this, that he should practically go through with his own hands every part of the process of the construction and equipment of a modern ship. When he has done all this, he is ready to start in to do his life work of learning to be a shipbuilder.

It would not be possible within the limits of one lecture to go very far into the art of shipbuilding.

When the naval architect has determined all the characteristics of the ship to be built, and computed the strength of materials that will be required to make her seaworthy and to entitle her to the highest class at Lloyds, or any other of the classification societies in which she is to be rated, a half model of the ship is prepared from the lines. This is usually on a scale of $\frac{1}{4}$-inch to the foot, or one-forty-eighth of the full size. On this half-model all the framing and all the plating is lined off, and as soon as this is ready the material orders are got out. Besides the model, framing and plating plans are prepared for all the interior work; the inner bottom, if she is to have water ballast; and all the decks and bulkheads. An expansion plan is also made from the model of the outside plating, which represents the outer skin rolled out flat. This gives the shape of every plate.

The specifications for the material are got out in the sequence in which the material is required by the shipbuilder, and every plate and bar has a designating mark and number by which it is identified when received into the

yard for use. It is of the first importance to get these material orders off to the mills promptly, as the possibility of getting the ship ready on contract time depends largely on this preliminary work.

When the material orders are off, the design for the ship can be expanded for practical work in the yard. This may be done by the naval architect or the master builder; in fact, they are often the same person. This operation brings us to the geometry of shipbuilding, and this in many respects for iron shipbuilding is identical with that for wood shipbuilding, for there are frames of steel and planks of steel crossing each other, as frames of wood and planks of wood cross each other in a wooden ship. So there is little difference between laying down an iron or steel ship on the floor, and taking it off in moulds, and the same process in wood.

The small scale plans prepared in the draughting-room must be reproduced full size on a wooden platform or floor for the cross sections, or what is called the body plan. This floor must be somewhat larger than the section of the vessel. If the proposed ship was to be 50 feet beam and 35 feet deep, the floor for the body plan should be about 60 feet by 45. This floor is usually made of clear pine, and about 4 inches thick, the planks being say 4 inches square, and secured together by edge fastening, so that the surface will have no nail holes. When this is dressed off and coated with black, it is ready for use. In a large yard this floor is large enough to take the body plan for several ships at the same time. The lines are cut in with a scrieve, making a score about $\frac{1}{8}$-inch wide and $\frac{1}{8}$-inch deep, so that for each new ship laid down on this floor $\frac{1}{8}$-inch must be planed off to take out the old lines. When the body plan is laid down it shows in transverse section at right angles to the keel the leading edge of each frame. From this leading edge each frame will have a bevel, determined by the level line at that point. The iron planks or plates will in like manner have to follow certain ribband lines drawn as nearly as may

be square to the ribs they cross. All longitudinal framing and bulkheads, with deck beams and stringers, are also laid off on this body plan.

On this full sized plan the frame-setter bends his mould strip and transfers the shape of each frame separately to the iron floor on which the hot frames from the furnace are set. This full sized plan must be preserved while the ship is in progress, as every part of the structure must conform to the shape laid down for it there.

There is a difference, however, between the laying down of an iron or steel ship and a wooden ship, and it is in the relationship between frame and skin. So the laying down and taking off of an iron ship requires to be set about in quite a different way from that of a wooden ship. In the wooden ship the geometrical problem is, from a given design to construct the moulds of all the parts of the frame work. In the iron or steel ship, the geometrical problem is, from a given design to construct the forms of all the parts of a skin, so that the skin has first to be designed, and the frames follow. In a wooden ship, when the frame is completed the planking is laid on to the frame and takes its shape from the frame, bending either on the flat or edge, or having a combined bend and twist in both directions. But as with iron or steel plating there can be no edge bending, each plate must have its proper form to suit its place on the skin of the vessel. So that from the model an expansion plan of all the plating must be made in order to get the proper shape of each plate.

The best illustration of what has to be done in designing the skin of an iron or steel ship is what the tailor has to do when he cuts out a tight-fitting dress coat. The cloth as it lies shaped out on the tailor's cutting board bears as little resemblance as possible to the coat as it sits around the chest of his well-fitted customer. The tailor's is a highly geometrical art, and a perfect-fitting coat is sufficiently difficult to produce for fortunes to be made by knowing how to do it. The iron shipbuilder's art is the

cutting out of the tailor on a grand scale, but to understand how much more difficult it is we must conceive the tailor asked to manufacture a perfectly fitting dress coat out of square goods of steel plate!

To design the frame, but especially the skin of a steel ship, is a problem requiring the highest geometrical training and skill. By that I mean the doing it quickly and truly, so as to do it strongly and reliably. A badly built steel ship with material forced into unnatural shapes, is far less valuable as a property, and far more dangerous as a conveyance, and less trustworthy, than a well-built wooden one. For under severe stress the wooden ship will groan and complain, and show signs of weakness long before danger arrives; and will bend with the waves and struggle with them long before giving way. But the struggle and the failure of a badly built steel ship comes without warning.

Besides giving every bar and every plate its proper shape, there must be such a skilled uniting of every part as to make the completed structure possess the greatest strength possible. The pitch and size of rivets must be in the proper ratio to the section of material they unite, and riveting for watertightness or for structural strength must be carefully considered; skill in laying off the rivet holes, and in transferring the position of holes in one plate to another, so that the holes will be fair when the plates come together, must be possessed; where hand riveting is necessary and where machine riveting can be adopted, both for economy in cost and durability of result, must be considered.

The shipbuilder must also exercise great skill in the handling of material, for herein lies the chance for economical production in the shipyard. Mechanical means for handling the material must be employed nowadays at every stage in the operations; and the arrangement of tools should be such that the material should keep steadily moving in the direction of its final location on the ship as it goes through the various manipulations required.

While the main structure, consisting of the frame work,

the skin, the bulkheads, and decks, is being worked into the form of the ship that has been designed, the shipbuilder must at the same time carry on other important matters. If it is a steamship that he is building, the engine seatings, the boiler seatings; arrangements for the shaft coming through the stern work to receive the screw propellers, and a well in which it works, must be provided. Or, if is to be a side-wheel ship, main bearing supports and paddle beams must be worked into the structure of the ship. Arrangements must also be made for taking in sea water to the condenser and discharging it overboard when it has done its work. A shaft tunnel must be constructed through which the shaft passes to the stern. All the needs of the engineer must be anticipated, and provision made properly to secure all his work. Then, if it is a passenger ship, living accommodations of the most elaborate description may have to be arranged for, and all the joiner work, plumber work, painting work, upholstery work, tiling, and decorative work of every description must be got ready for its place by the time the hull work of the ship is complete.

But when the hull has really become a ship in form and strength, so long as she remains on dry land, she is no ship; and it is the finishing stroke of the skill of the shipbuilder to place her safely in the water. The transference of so great a weight as two, three, or six thousand tons out of the building yard into the sea, appears at first sight an arduous and difficult problem, but with sufficient foresight and forethought it becomes so easy as to be little more than routine. Where these are wanting it may be extremely difficult or next to impossible. Ships have stuck half way on their way to the sea, and broken their backs, and required as much repair as if they had suffered shipwreck.

Where I was brought up there was about twenty-four feet rise and fall of tide, and a stuck launch was a disaster indeed. I remember an iron ship having been left, by an imperfect launch, with her bow on the edge of the building yard and her stern on the bottom, with her middle in the

air, and serving as a notable example of the strength of an iron ship.

Another danger is that the ship may stubbornly refuse launching, and choose to stay on land. It also sometimes happens that, after refusing to go when wanted, the ship launches herself at an improper time. There was a case of a large battleship launched some years ago on the Clyde, Scotland, when the ship started to slide down and continued to slide, but so slowly that it took several hours to reach the water, and then, when the water had fallen so far that the ship was considerably damaged by leaving the ways without sufficient water at the foot of the ways to float her.

Against all such casualties it is the object of wise launching arrangements to provide. First, the launch ought to take place with certainty at the exact time wanted. Second, it must take place easily and with a moderate speed. Third, provision must be made against straining.

These are the ordinary conditions to be foreseen, but there are sometimes others. The water may be shallow, or there may be very little room for the length of the ship, or she may have very far to go to meet the water, and for such special cases peculiar provisions are required. The ship may be launched equally well, so far as launching is concerned, with head foremost, stern foremost, or broadside on, or at any required angle of obliquity to the keel, provided the following condition is observed: the ship must remain thoroughly well land-borne until she becomes thoroughly well water-borne. This is the first difficulty, and easiest overcome in the usual type of ship, by launching stern first. While the ship is being built she is well supported by the long rows of blocks on which her keel rests from end to end. These carry nearly her whole weight. In addition, she is kept upright by a line of bilge blocks on each side, and by shores outside of them all around, which prevent her from swaying to either side. In this condition the ship is finished, and is perfectly

land-borne, but before she can be launched all these supports must be removed. The first step toward launching, then, is to provide a new and different arrangement of supports, entirely independent of those upon which she has been built, but which must support her for a little while, as perfectly as they have done for a long while. In the usual mode of launching this is accomplished by laying down on each side of the center line of blocks two independent lines of supports for which a proper foundation is provided in the plan of the yard. These lines of supports consist of two parts, the upper being the cradle and the lower the ways of the launch. These are extended from near the bow, a long way down into the water, while the cradle extends no further than the ship herself.

The ways form a kind of railroad to carry the ship into the water; they are laid perfectly smooth, even, parallel, and continuous down the slip into the water; but, as they have a heavy load to carry, and may have great pressure to endure, they must be laid on a good foundation, and must be kept in perfect alignment.

Where we launch here, over mud at the foot of the slip, a large platform of plank is made and sunk on the mud, the lower end of the ways being laid on this platform, and for very heavy ships piles are driven close together out as far as the ways have to extend, and cut off at the proper depth below the surface of the water to receive the ways. Great precaution must be taken to have all this work true to line, and built strong and sound. This is the first provision for safe launching.

The second provision is to lay the ways at the right slope downwards. This is a matter of critical importance. If the slope be too small, the ship will refuse to move; if too great, she will attain a dangerous speed, and may enter the water at such an angle that she cannot be water-borne, and may come to a stop like the ship I referred to with one end fast on the slip and the other on the ground, subject to the falling tide. One-half inch inclination to every foot would

produce a dangerously slow movement; in fact, the ship would have to be assisted. Five-eighths of an inch to every foot will produce a very easy launch if the ways have not too much surface in proportion to the weight. Three-fourths inch to the foot is the inclination usually adopted, if there is no other circumstance requiring something different. From what I have said about angle of launch it will be readily seen that the choice of the place on which the ship is to be built, and the height at which she stands above the water, must all be carefully foreseen when the keel is laid on the blocks.

Another point that the shipbuilder must be careful about is the amount of surface that he provides on the ways. This is determined by the launching weight of the ship. The most successful practice would indicate between two and three tons to the square foot of surface. This is lubricated with the well-known shipbuilder's mixture of tallow and soft soap. First hard tallow is applied hot to the surface of the ways, so as to form a perfectly uniform coating; then plenty of the soft soap is applied as the lubricant.

To prevent any side movement of the ship during launching, a ribband or flange of stout planking is bolted to the inside edge of the cradle or sliding ways, leaving a clearance of about one-half inch. This serves the same purpose to the ship that the flange on the wheel serves to a locomotive engine, it prevents it from leaving the track.

I have mentioned the cradle that forms the carriage on which the ship glides along the ways. This is formed, as stated, of two upper ways which form the base of the cradle. On this base we place blocks to fit exactly under the ship, filling the space between her skin and the upper or sliding ways. The quantity of this blocking depends upon the shape of the ship, and there is often difficulty in properly carrying the weight of the ship to the sliding ways, especially near the ends. So a critical point with the shipbuilder is to decide how long he can make his cradle,

and give each part its proportion of the load. This cradle must fit the form of the ship exactly, and underneath every block on the cradle a wedge-piece is carefully fitted; in a large ship there are hundreds of them. But before allowing the ship to rest on the cradle and the greased ways, many precautions are necessary to prevent from moving before the intended time, and to insure her going when the proper time comes.

The most important of these contrivances are called the "dog-shores." They are the last impediments to the motion of the ship, and are removed only at the instant of launch. The dog-shore is usually a stout strut of oak with an iron shoe on each end. A strong stop is bolted on the ways to receive the heel, and a similar stop is bolted on the cradle to receive the head of the dog-shores, so that the cradle could not slide without first crushing the dog-shore to pieces. There is one of these on each side of the ship, sometimes two. They lie nearly horizontal, and as long as there is no pressure on them they would fall out of their places, except that a small prop is fitted under them to support their weight. This is called a "trigger." At the last moment, when all other supports have been removed, there is usually an enormous pressure on the dog-shores; sometimes sufficient to crush them before they are knocked out. Sometimes a heavy weight is suspended over the dog-shores. That is electrically released by the lady that does the launching.

But we are not quite ready for that yet. Other precautions and matters of forethought have to be attended to. The great wooden cradle on which the ship is carried down to the water must be removed at once from under her, for the pressure of the water makes it adhere firmly to the bottom of the vessel. All the pieces forming the cradle are therefore fastened together and to the timbers forming the sliding ways, while by strong ropes the whole is made fast to a firm post in the yard. Enough slack is given this rope as will allow the ship to be clear of the ways and

afloat, when the rope tightens and holds the cradle firmly, while the speed of the ship carries her on and out of the cradle.

If there is not much room at the front of the yard, which is often the case, provision must be made for stopping the ship. At the yard of the Union Iron Works we are to launch a ship next month which is five hundred feet long, while there is only about eleven hundred feet space to receive her. The usual method, and the one we adopt, is to use the anchor chains of the ship, one on each side, and stop the momentum by them. The power required to stop the ship must be all figured out beforehand, and must also be applied in a given space. For instance, if the ship is to be allowed to go three hundred feet after she floats, and she weighs four thousand tons, going at fifteen feet per second, we have fifty-six thousand foot tons to take up, less the resistance of the water to the motion of the ship. The way in which this is done in say three hundred feet is to stopper or secure the chains by ropes of known strength at intervals of say ten feet apart. These all break in succession, about one second apart. There are thirty of them on each side, and the work done in breaking them brings the ship to rest.

Before the launch all the shores and staging is removed, the soft soap applied to the ways and cradle, and all the pieces forming the cradle properly placed and fastened. About two hours before the time for launching the transfer of the ship from the fixed blocking on which she has been built to the cradle that is to carry her to the water begins. A force of men on each side using a battering ram begin at the after end of the cradle and drive home the wedges under the blocking of the cradle. The shipbuilder watches this operation with great care, the object being to get an even pressure by the cradle all along its line on the skin of the ship. After this has been done a large part of the weight of the ship still rests on the original supports. After a few minutes' rest the men again begin at the stern

to remove each alternate block under the keel. This has been provided for months before, by having the block directly under the keel made of straight-grained wood, and short enough to be readily split; so the men split these pieces out with steel wedges. After each alternate block has thus been removed, it can be noticed that the cradle is now taking more load.

Another short rest is given the men, the shipbuilder having carefully timed each operation. Then the final operation begins at the stern again, the removal of the remaining blocks and the bilge blocks. Considerable suppressed excitement now prevails amongst the men, and the shipbuilder may be seen at intervals anxiously watching a line on the cradle to see if she moves. Everything must be removed this time, and from aft forward, and as this proceeds, especially in heavy ships, the desire to go begins to express itself by signs that the shipbuilder well knows. At last every support is out except the dog-shores, and the interesting moment has come. Everything has been foreseen and provided for. Nothing now remains but to baptize the ship and launch her into life.

"All ready?" "All right!" "Out triggers!" "Down dog-shores!" and off she goes on her career of good or evil fortune.

Our ship is now a ship indeed, for as a general rule, and according to some points in law, a ship is not a ship until she floats. She is then baptised, named, and has a body which can be called her own; or, rather, she may then have an owner. She may become a corporation; she can incur debts, make contracts, and conduct law suits. She also may be married to a ship husband, and become initiated into the functions of social, legal, and active corporate existence. She enters into life, property, and action.

When launched she becomes a ship, but she may be a ship in very different degrees of maturity. She may be launched fully equipped for immediate service and ready for sea, or she may be launched bare, naked, and destitute of

anything required to fit her for the active duties of life. She may be a ship and nothing more, or she may be a ship wanting nothing. And there is a wide difference between the one and the other. Most ships are now fully completed and equipped by the shipbuilder.

The battleship Wisconsin, just completed at the Union Iron Works, was completely equipped by the builders, the armor plates and the guns being supplied by the Government to the builders to be fitted in place by them. So that at the shipbuilders' yard she went into commission ready to do battle for her country.

Merchant ships are also, as a rule, fitted out complete by the builder. In merchant ships carrying large numbers of passengers, the fitting out complete becomes an elaborate business, bringing into service nearly every known craft. Combined with the skill to build a staunch and seaworthy ship there must be the skill to make her a comfortable place to live in, with every modern luxury, perfect sanitation, perfect ventilation, perfect table service, and attendance to every want. How to bring all this into existence and work it into harmonious relationship with the structure of the ship he builds, is the art of the shipbuilder. With scientific knowledge must be combined a cultivated taste, and a breadth of culture that a thorough education alone can impart.

I have not touched in these lectures the subject of marine engineering, which cannot be separated from shipbuilding, for the shipbuilder must know much about the marine engine, it being his great instrument of propulsion; and the marine engineer must know much about the ships that his engines are to propel.

So I trust to see some day in the not too far distant future, conspicuous among the great halls of learning to be reared here, two noble buildings, one for the study of naval architecture, the other for the study of marine engineering, and between them an experimental tank second to none in the world, where the forms of great steamships to carry a

mighty commerce between the newest and the oldest civilizations on earth will be evolved and brought to such a degree of perfection as will enable our ships to command the trade of the Pacific. This is California's opportunity if we could only get her people to realize it, and set to work before it is too late.

THE ASSOCIATION OF AMERICAN UNIVERSITIES.

HISTORICAL NOTE.

On the twenty-fifth of March, 1898, the Graduate Council of the University of California appointed a committee to consider the advisability of conferring with other universities upon certain important matters of common interest, specifically the status of American students in foreign universities. While this committee was engaged in its work a letter was received from the President of the Federation of Graduate Clubs soliciting suggestions concerning the work of the Federation. The resulting correspondence made it evident that the problems, such as migration, with which the Federation was then struggling, depended so much on the attitude of the leading American universities towards one another, that a solution could only be hoped for through joint deliberation of the universities; and in its report of February 24, 1899, the committee recommended that conference be had with a few of the greater universities, not only on the original question, "the status of American students in foreign universities," but also on the standards for higher degrees, and other matters of common interest.

The effective outcome of these deliberations was a letter addressed to the Presidents of Harvard University, Columbia University, Johns Hopkins University, and The University of Chicago, inviting their coöperation in the issuance of a

call for an early conference of representatives from a suitable number of the greater universities. Favorable replies to this letter having been received, the call was issued under date of January, 1900, and was signed by the Presidents of Harvard University, Columbia University, Johns Hopkins University, The University of Chicago, and the University of California.

The invitation to the conference was extended to the following institutions: University of California, Catholic University of America, The University of Chicago, Clark University, Columbia University, Cornell University, Harvard University, Johns Hopkins University, University of Michigan, University of Pennsylvania, Princeton University, Leland Stanford Junior University, University of Wisconsin, Yale University.

All of these institutions promised coöperation and twelve of them sent delegates to the first conference, which was held on the 27th and 28th of February, 1900.

The report of the delegates from the University of California to the second conference follows.

SECOND ANNUAL MEETING.*

The second annual meeting of the Association of American Universities was held in the city of Chicago, February 26, 27, and 28.

The delegates met for the first time at luncheon in the Quadrangle Club of the University of Chicago, on Tuesday, February 26th, in response to the invitation of President Harper of the University of Chicago. About forty guests were present at the luncheon including the delegates from the different universities, Mr. Frederic Harrison, and Dr. W. T. Harris, the United States Commissioner of Education. The luncheon was informal and was immediately followed by the first session of the conference, which

*Report presented to the Graduate Council, March 11, 1901, by Professors Irving Stringham and Armin O. Leuschner, delegates of the University of California.

was held in the Haskell Assembly Room, University of Chicago. The delegates representing the fourteen universities of the Association were:

The University of California—Professor Irving Stringham, Professor Armin O. Leuschner; The Catholic University of America—Right Rev. Monsignor Conaty, Rector, Rev. Edward A. Pace, Dr. Daniel W. Shea; The University of Chicago—President William R. Harper, Professor Harry Pratt Judson, Professor Rollin D. Salisbury, Professor William Gardner Hale, Professor Starr Willard Cutting; Clark University—President G. Stanley Hall; Columbia University—Professor Nicholas Murray Butler; Cornell University—Professor Thomas F. Crane; Harvard University—Professor LeBaron R. Briggs; Johns Hopkins University—Professor Ira Remsen; The University of Michigan—President James B. Angell; The University of Pennsylvania—Professor William R. Newbold; Princeton University—Professor William F. Magie; Leland Stanford Junior University—Professor John C. Branner, Vice-President; The University of Wisconsin—Professor E. A. Birge, Acting President, Professor Charles Forster Smith; Yale University—President Arthur T. Hadley.

All the delegates were present, except President Hadley, who was called home before the opening of the conference on account of illness in his family.

At the final session of the conference provision was made for the publication of the proceedings of the Association from the date of its organization, and it is therefore deemed unnecessary to present in this report, in addition to the resolutions adopted, more than a brief synopsis of the discussions.

The following business was transacted at the various sessions before and after the discussion of arranged topics, Dean LeBaron R. Briggs of Harvard University presiding: President Harper, for the University of Chicago, secretary, presented a report containing announcements and suggestions for business to be transacted. He announced:

1. That all the universities named in the articles of organization had accepted membership in the Association.

2. That the report of the temporary secretary to the executive committee, not having reached the committee until after its adjournment, had not been acted upon.

The following action was taken:—

1. Votes were passed thanking the Quadrangle Club and the University Club for hospitalities extended to the delegates.

2. Professor Judson (Chicago), Smith (Wisconsin), and Shea (Catholic University), having been appointed a committee to nominate officers for the ensuing year, reported on Wednesday afternoon, and the following officers were elected: President, Columbia University; Vice-President, the University of Michigan; Secretary, the University of Chicago; fourth and fifth members of the executive committee, Harvard University and the University of California.

3. Professor Leuschner (California) was asked to prepare reports of the meetings for publication in the daily papers.

4. In accordance with instructions previously received, the executive committee at the same session submitted a report embodying the following recommendations:

(*a*) To adopt the suggestion of the American Association for the Advancement of Science, presented through Professor Butler of Columbia University, that the universities of the Association join in recommending the setting aside as convocation week for the annual meeting of all learned societies, the week beginning Monday after Christmas day.

(*b*) To defer the election of new members until a definite basis for such elections shall be adopted.

The report was adopted, and on motion of the California delegates, amended by Professor Magie for Princeton University, the following procedure in electing new members was agreed to:

The executive committee shall invite from the univer-

sities representing the Association nominations of new members.

At least one month before each annual meeting such nominations as have been approved by the executive committee shall be communicated to the members of the association. The proper authorities of the universities composing the association shall be requested to instruct their delegates with a vote on each university approved for membership by the executive committee. In accordance with the articles of organization a three-fourths vote will admit to membership.

In the discussion preceding the adoption of this motion Professor Newbold expressed the opinion that the association should at once settle on the qualifications on which new members shall be admitted. He stated that the president of a prominent university had severely criticised the exclusiveness of the Association, and he feared that the postponment of the election of new members might result in the formation of a rival association.

In reply Professor Leuschner said: "The experience which the original five universities have had in selecting the universities which were invited to our first annual meeting convinces me that it would be exceedingly unwise to decide at the present moment on the particular qualifications which will entitle other universities to membership. We certainly do not know whether we shall wish to stand by the policy which we may adopt to-day. It would be far wiser to follow a method similar to that adopted by the original five universities; namely, to admit universities on their general standing rather than on the basis of any stated qualifications. Furthermore, it was provided at our last meeting that, whenever possible, the executive committee should communicate in advance to the members of the Association the names of the universities which are to be voted upon for membership at any meeting, and I doubt very much whether Professor Stringham and I would be willing to cast our vote on any institution which might be

nominated to-day without having been previously instructed with a definite vote by the Graduate Council of the University of California. I therefore hope that the motion will prevail."

A communication from the Federation of Graduate Clubs touching the interests of graduate students, particularly with reference to the awarding of fellowships, was passed over to the executive committee with instructions to make suitable acknowledgment.

At the final session it was voted that the expense of publishing the proceedings of the Association be borne in equal shares by its members.

The place and date of the next meeting are to be determined by the executive committee.

Before final adjournment a vote of thanks was tendered the University of Chicago for courtesies and hospitalities extended to the Association during its second annual meeting.

In a letter addressed to the Association President Eliot asked for an interpretation of the meaning of the words "graduate study" in the following paragraph of the articles of the organization:

"It is founded for the purpose of considering matters of common interest relating to graduate study."

Professor Remsen desired to have the work of the Association restricted to the problems relating to the Philosophical Faculty proper.

President Harper doubted the wisdom of limiting the possibilities of the Association.

Monsignor Conaty asked whether in forming the Association the original five universities had contemplated at some future time the extension of the field now covered by the Association. Professor Leuschner replied as follows:

"There is nothing contained in the correspondence which passed between the original five universities prior to our first conference that would indicate that the work of the Association should be restricted in any way. On the

contrary, we took it for granted that in the course of time the Association might take up any and all problems of higher education, whether they relate to the so-called Philosophical Faculty, so far alone represented in the Association, or to the professional faculties, like medicine and law, or to the engineering faculties. In fact, it will be remembered that at the close of the last session the California delegation submitted among others the following suggestion which, on my own motion, was referred to the executive committee for consideration: 'That the Conference consider itself a general organization having separate sections in all the learned professions, including the technical sciences, and that steps be taken for the organization of such other sections.'

"I may also mention that at the last meeting we received a communication from the American Academy of Medicine requesting information regarding the relation of medical colleges to the undergraduate courses, which communication was also referred to the executive committee."

In accordance with the programme prepared in advance by the executive committee, the topic of the first session was "Migration Among Graduate Students." The discussion was opened with a paper prepared for Johns Hopkins University by Professor Ira Remsen, who spoke in part as follows:

"Migration is on the whole a good thing. In Germany an ideal system exists. A student receiving all his education in the same institution must necessarily be narrow. While a migration of a peculiar character does already exist, it is due largely to dissatisfaction among students and is not prompted by the best motives. Is migration of good students possible, should it be encouraged, and what results may be expected from it? There are many obstacles in its way, among them the loyalty of the graduate student to his alma mater, our system of administering fellowships, the difficulty of receiving full credit or proper status in changing residence, but most of all the

natural disinclination of a professor to send off a good student to another university while we are making every effort to increase the number of our graduate students. Each university is trying to work out the problem for itself. In England and France migration practically does not exist. While the members of the association are probably in favor of the plan of migration, there is little prospect of practical results in this direction."

President G. Stanley Hall of Clark University took issue with the final statement of Professor Remsen, and contended that a great deal of migration is already taking place.

"Many professors tell their students to go to other universities," said President Hall. "Everything possible should be done to encourage migration. If a student would select his university merely from a desire to hear the best men, it would be a stimulus to the professors to turn out their best work. I hope to see the time when it makes no difference whether an eminent man has one student or many in his classes. It is a distinct disadvantage to a professor to have too many fellowships at his disposal; quality of work, rather than money, should count in attracting students. It would be well to offer fellowships to enable graduate students to go to other universities."

President Harper of the University of Chicago said that men were being urged every week to go from Chicago to other institutions, where they could specialize to better advantage on certain lines. "If we should put down all that we have in common," said Dr. Harper, "we should be surprised at the uniformity of conditions, and how easy it is for students to change from one graduate school to another. That the plan of sending students away works well is shown from the fact that three students whom we sent away, have recently received appointments in other institutions. A student will be narrow if all his work is done in one place. It is not so much a question of loyalty as convenience.

"It is easier for a student to continue in a university in which he knows the regulations and in which he is acquainted. During the first two years most of our graduate students came from Harvard University, then from Michigan. One-third of our graduate students of the present year have studied elsewhere; so have, also, most of our undergraduate students. Fellowships do not hinder migration."

Professor Butler remarked: "Facts will justify my impression that Professor Remsen has greatly magnified the existing difficulties. In my own department I have had in ten years 417 graduate students of whom ten per cent. had taken work elsewhere. Out of twenty-one who have taken the degree of Doctor of Philosophy uuder me, only four took all their work at Columbia University. On the whole these four were not the strongest men. Migration is now going on vigorously, and most of our fellowships go to outsiders. Letters are constantly received from other universities asking us to continue with some of their graduate students, and *vice versa*. We have just written to Professor Howison of the University of California, asking him to take one of our men. There is no such thing as graduate school loyalty. Serious co-operation rather than regulation is necessary. Not every department in a university can be maintained at the highest efficiency. At Columbia we insist on competence for the doctor's degree, but we do not insist that it can be had in only one way. Migration is largely dependent on the attitude of the universities towards one another."

Professor Newbold of the University of Pennsylvania endorsed Professor Butler's remarks: "We advise students to go to other universities. Fellowships work both in favor and against migration. A notion prevails with the graduate student that he must take his degree where he holds his fellowship."

Professor Crane of Cornell University confirmed Professor Butler's remarks: "The amount of migration is

very much larger than Professor Remsen seems to think. Graduate students constantly come and go at Cornell University. Our fellowships are frequently used to enable students to study elsewhere, especially abroad. Credits and status of students coming from other universities are easily arranged for."

Professor Smith of Wisconsin University stated that fifty per cent. of their graduate students come from other universities.

Professor Stringham of the University of California said:

"The conditions in California are favorable to migration, both graduate and undergraduate. Hitherto we have sent more graduate students to other institutions than we have drawn to ourselves, but at the present moment undergraduates in considerable numbers are coming to California from all parts of the United States and in fact from many countries, and the number of graduate students who have taken their bachelor's degrees in other institutions is increasing. In particular there is free movement of graduate students from the University of California to Stanford University and vice versa. With us therefore, the migration of students is already a live question. At the present time we have representatives from one department (mathematics) studying at Göttingen, at Zürich (two students), at Harvard, and at Chicago; and these young men have gone away from us in response to our urgent advice. Whatever personal interests our professors may have in this matter, I think they are willing to waive them in the interests of higher scholarship. We desire to take the large view of this question."

Professor Judson, of Chicago University, urged upon the attention of the Association the subject of migration of professors: "The University of Chicago is exchanging professors, not only for the summer session, but also during other parts of the academic year." He made a strong plea for the migration of professors, emphasizing the advantages

resulting therefrom to the universities, professors, and students.

Professor Remsen humorously objected to being called a pessimist on the question under consideration. "I gladly take back anything that I may have said in disparagement of migration. I am unable to explain the fact that my experience differs from that of the other delegates, unless conditions in chemistry are different from those in other subjects. With five hundred students who have come under my observation in twenty-five years very little migration has taken place."

Other delegates made brief remarks in favor of migration. Dean Briggs read an expression of opinion for Harvard University, which was favorable to the migration of students and professors.

Monsignor Conaty expressed the opinion that the migration should be treated with a view of protecting the doctor's degree. "This, I believe, was our object in forming the Association. The question of migration largely depends on the uniformity of requirements for the doctor's degree, and no practical results can be arrived at until the matter of requirements has been settled."

At the second session, held on Wednesday forenoon, the type of examination for the doctor's degree formed the subject of discussion. Professor Magie presented a paper prepared for Princeton University, and said in part: "The degree of Doctor of Philosophy implies power to do original work and to supervise and criticise the work of others. One of the tests of the fitness of the candidate is the examination." The method of examining for the degree in Germany was detailed, and it was contended that a similar method should prevail in this country. "It is characteristic of this method that the examination is held orally on large subjects (as physics) and not for the purpose of assigning relative rank."

Professor Newbold, of the University of Pennsylvania, said: "Our conclusions are directly opposed to those

expressed in Professor Magie's paper. When our system of examinations for the doctor's degree was organized in 1882, we followed the example of Germany. But this was soon abandoned as unsatisfactory. I have conducted about one hundred such examinations, but do not believe in them. I do not see the necessity of continued contact of the candidate with the professors. We have now introduced written examinations in place of oral and find them more satisfactory. We consider the oral examination absolutely useless, except as an academic ceremony. But for this we have now provided by means of a faculty meeting, at which the candidate is present and gives a full account of his work. This insures the principle of publicity. Our present system is of recent origin, and experience must show whether it is the best."

Professor Remsen: "We have tried every possible form of examination at Baltimore, and shall undoubtedly continue to do so. There are two main types of examinations, (1) those which call for action by a society for the prevention of cruelty to animals, (2) those of a liberal character. The candidate can be better judged by years of contact. Yet I find out something interesting in every examination. I do not attach much weight to the examination if I have had an opportunity to form an opinion about the candidate's qualifications." He cited cases where excellent men had gone to pieces in the examination, while other very moderately prepared candidates had made a good showing. He had therefore lost all faith in the formal examinations as an absolute test. "The examination should be a long and unconscious one on the part of the candidate, lasting over two or three years." He did not see, however, how the oral examination could be avoided. "It must be retained as a stimulus to the student to make his best efforts." In response to a question by President Angell, whether professors, who had not taken part in the instruction of the candidate, assist at the examination, Professor Remsen said that this had been the custom at Baltimore, but that it was found to be unsatisfactory.

President Angell then called for information concerning the procedure in German universities in recent years.

Professor Stringham suggested that Professor Leuschner be called upon for his observations.

Professor Leuschner: "There appears to be no uniformity of conducting the examinations in different German universities, nor even in different departments of the same university. My own experience was somewhat out of the ordinary, and therefore does not entirely represent the general case, but I shall be glad to give it for what it is worth. I went to Europe, while on a year's leave of absence, after having completed in this country all the requirements for taking the Doctor's degree in the University of California, with the exception of presenting a dissertation. At Berlin, which university I had selected as offering the best opportunities in my chosen line, I was urged to go elsewhere for a doctor's degree. The Professors concerned were willing enough to have me become a candidate for the degree, but they contended that the regulation, demanding the 'triennium' in German universities, would make it impossible for me to present myself at Berlin. Having decided to take my chances on this point, I took up my studies at Berlin and presented a dissertation to the Dean, Dr. Dames, after about one year. The Dean is not authorized to receive a dissertation unless accompanied by a certificate of the 'triennium,' but Dr. Dames, personally believing that an exception ought to be made in this particular case, desired to have the senate concur in refusing my application. The senate however, on the urgent recommendation of the professors concerned, appointed a committee to report on the thesis. The report being favorable, a 'Dispensation' from the 'triennium' was secured from the 'Cultusminister' and an oral examination was granted. I must admit that I had the good will of the leading Berlin astronomers through interchange of publications and other scientific intercourse. With reference to the examination I may say that while it was

searching and exhaustive, covering the whole field of astronomy, and several branches of higher mathematics, in addition to psychology, which latter is demanded from all students who do not offer the history of philosophy, it involved no trick questions, and the questions could readily be answered by one who had taught most of the subjects for a number of years. At Berlin the candidate generally pays a formal call on his examiners a few days prior to the examinations, and he is frequently asked in what particular branch of his major and minor subjects he is most interested. The examiners are appointed by the Dean, but generally the student's preferences are regarded. Frequently the examination is merely a matter of form. With reference to securing credit at Berlin for work done at home, as part of the 'triennium,' American students have the greatest difficulties. The individual Professors, with many of whom I discussed the subject, were in favor of accepting residence at leading American institutions, but the senate can take no action without discriminating arbitrarily on the American institutions. I was told that the problem might be solved if we would give official information concerning the character of our graduate instruction. It will be remembered that the desire to secure such information from each other resulted in the first meeting of this Association."

Professor Stringham then outlined the practice at the University of California: "The organization at California is in its early stages but we have a method that is working fairly well. We are guided to a considerable extent by the practice in sister universities. We do not pretend to set up a standard independently of other institutions. We aim at thoroughness, accuracy, publicity, and record. In order to bring about these ends, besides the usual safeguards of committees who report at frequent intervals upon the student's progress, we print a programme of the examination, which is placed in the hands of the candidate at the examination, and is distributed to those in attend-

ance. The examination is public and oral. Printed invitations are issued by the committee that conducts the examination to such members of the university, both professors and graduate students, as are likely to be interested in the examination. The thesis and the examination upon those subjects that are involved in the thesis, form the most important part of the test. The questions to be asked of the candidate are not printed in the programme."

Specimen copies of some of the California programmes were distributed to the delegates, and elicited much interest.

Professor Shea, of the Catholic Universitv of America, endorsed Professor Leuschner's remarks concerning the examinations in German Universities. He added—"that the examinations seemed to be more rigorous at Harvard than in other places, where it was sometimes merely a matter of form. The Catholic University lays the greatest stress on the dissertation which is submitted to specialists in other universities for criticism."

Professor Smith, of Wisconsin University, spoke of his experiences at Leipzig twenty years ago, when he had been allowed to select the examining professors. The thesis seemed to be the most important part of the examination in his case.

Professor Hale, Chicago University, thought that the thesis should form an important, but not the sole test, of the candidate's fitness for the degree.

President Harper expressed himself as being well pleased with the printed programme adopted at the University of California. "We have decided," he continued, "to introduce the same system at Chicago. It gives a good all-round understanding of the case on the part of the student, the professors, and others present, and insures the principle of publicity."

President Hall, of Clark University, spoke on the importance of a period of candidacy. "At Clark University we have dispensed with written examinations, and with publicity in the oral examination, which is conducted

in the strictest privacy. Steps should be taken to protect the doctor's degree."

President Angell called for a statement from Harvard University.

Dean Briggs said in reply, "A thesis, to be accepted by Harvard University, must add knowledge to the subject. The examination is conducted by a large division, of which there are several." He then explained the Harvard system in detail, as printed in the Harvard Catalogue.

Professor Crane of Cornell University declared that the discussion had convinced him that substantial uniformity as to the types of examination exists in the leading universities. The procedure at California University is an exceedingly interesting one. At Cornell University the candidate is also under the supervision of a committee, with which he has a definite understanding.

The discussion then narrowed down to whether the examination should be written or oral, Professor Newbold defending the written examination, while President Angell and others took the other side. Excepting the representative of Pennsylvania University, all the delegates favored an oral examination.

The subject for discussion at the third session, Wednesday afternoon, was "Fellowships." The discussion was opened with a paper for the University of Chicago by Professor Harry Pratt Judson, who said in part: "During 1898–99 the number of graduate students in the United States was over five thousand; this was at the rate of seventy-four to one million of population, as against five to one million in 1872. There were in existence four hundred and forty-four fellows, of whom two hundred and ninety-three belonged to institutions of this Association. There are material diversities in practice in amount of stipend, in point of requiring tuition fees, in point of requiring services, and in date of appointment. Students may apply simultaneously, and thus may be appointed, in several places. The number of predoctoral fellowships should be

lessened and more research fellowships with a larger stipend should be established. These should be for those who have made the doctorate with credit and who have already in hand a promising investigation."

Professor Butler: "At Columbia University we have two kinds of fellowships, university and endowed fellowships. The conditions are practically uniform for the two classes. For our thirty annual fellowships we have in general three hundred and fifty to four hundred applications. The applications are allotted to the heads of the departments in which the fellows desire to be appointed. These make full reports to the Dean, who then transmits the reports to a standing committee, which makes final selection of the applicants. To prevent the acceptance of a fellowship in another university after appointment at Columbia, all successful candidates are notified about ten days before the list of successful applicants is published, that they must pledge themselves to accept the fellowship, if appointed. The university fellows formerly received five hundred dollars and free tuition. Recently we have cut down the number of university fellows from twenty-four to eighteen and we make them pay tuition. We award the fellowships, in general, to applicants near the close of their graduate studies. There are altogether too many fellowships in this country in comparison with the number of those deserving encouragement. I counted three hundred and seventy-one about two years ago. At Columbia each fellow is required to undertake such research work as will lead to a doctor's degree. The fellows holding endowed fellowships are frequently reappointed."

Professor Remsen contended that the matter of fellowships was now being overdone in American institutions. "Men of brains, men who can do original research work of value, are fewer in numbers than the existing fellowships. They have to go to men whose mental caliber is not sufficient, and the whole system of fellowships suffers in consequence. This is our experience with the twenty

fellowships at Johns Hopkins University. A few graduate scholarships for the most promising students would answer our present needs. The balance of the funds thus released should be applied to research fellowships to be awarded to the most capable men after taking their doctors' degrees. But even then not enough men can be found who deserve thus to be encouraged. At Johns Hopkins fellows who are well on towards their doctor's degree may be called on to render assistance in instruction."

Professor Newbold: "Our principal fellowships are nineteen at $500 and five at $800. Some of these are restricted to graduates of the University of Pennsylvania. The conditions for award are, a bachelor's degree, French, German, and one year of graduate study. Senior fellows are allowed to teach two hours a week. They must publish their researches, and they are appointed for one year only. The departments in general are much strengthened through the work of the fellows."

Professor Birge, of Wisconsin University, stated that Wisconsin has fourteen university fellows who are expected to conduct one recitation a day or render a corresponding amount of laboratory assistance. A state institution, he explained, must have some return for its money.

President Hall said that the number of fellowships at Clark had been reduced from six to one and that they paid no fees.

Professor Crane stated that Cornell University spends nineteen thousand dollars annually on fellowships. Formerly these fellowships were awarded in open faculty meeting, but this was found unsatisfactory. They are now awarded outright to the various departments, which are held responsible for the appointments which they make.

Professor Stringham: "We are not embarrassed by an excessive number of fellowships at the University of California. We have but few, at most seven or eight, and we have no difficulty in awarding them. With the exception of the three fellowships in astronomy they may be

used for purposes of study in other institutions, and in some cases the recipients are advised to study abroad. We aim to make our fellowships aids to research, but they have not in every instance been used for this purpose."

Professor Stringham then referred to the following resolution of the Graduate Council of the University of California as approved by the Board of Regents:

"That persons appointed as fellows be required to devote all their time to advanced study; except that on the recommendation of the head of the department concerned, and by vote of the Graduate Council a fellow may be allowed to offer advanced instruction in the immediate line in which he is studying to an extent not exceeding two hours a week, or to assist advanced students in laboratory work not more than six hours a week."

Professor Magie contended that fellows were not in general as interesting a body of men as other graduate students.

President Angell said that the question of fellowships was not a problem in the state universities, as they had very few to award.

Dean Briggs said that out of three hundred and forty graduate students of Harvard, one-fourth hold salaried fellowships. In addition there are honorary appointments called John Harvard Scholarships, awarded to give the holder standing in other institutions. They are awarded by a committee. Dean Briggs referred to the Harvard Catalogue for further details.

The final session of the conference, Thursday morning, was devoted to the topic, "To what extent should a candidate for a doctor's degree show a knowledge of subjects not immediately connected with his major subject." The discussion was opened with a paper prepared for the University of Pennsylvania by Professor Newbold, who said in conclusion:

"1. The battle between the old classical ideal of liberal culture and the newer ideal of culture derived from the

pursuit of learning for its own sake in any field, is practically decided in favor of the latter.

2. It is probable that a new issue will be opened, in which the old names figure, 'liberal' culture being identified with *extensive* culture as against the *intensive* culture of the specialist. What will be the duty of the graduate school towards this issue?

(*a*) I would reply that the interests of the graduate school are not at the present time threatened by the degree of undergraduate specialization which we commonly meet.

(*b*) That the graduate school may safely allow considerable liberty of specialization to undergraduate students; that it is not possible to specify in advance any definite degree of specialization beyond which candidates for the Ph.D. degree will not be allowed to go.

(*c*) That the extremes of specialization can probably be prevented by the graduate schools' refusing to grant the doctor's degree in less than three years after graduation.

(*d*) That students who have specialized too much or too little as undergraduates should be encouraged by the authorities of the graduate school to specialize less or more in the course of their graduate work, and thus correct their early mistakes."

Following Professor Newbold, Professor Magie outlined the position of Princeton University on the subsidiary requirements. He took issue with Professor Newbold on various points. In the course of his remarks he said that Princeton University was so thoroughly convinced of the wisdom of requiring a knowledge of Greek in addition to Latin that he could not say what the result would be if a graduate of Harvard who did not offer Greek should apply for the doctor's degree at Princeton University. Professor Magie discussed somewhat in detail his impressions as to the relative quality of the undergraduate students in the liberal and scientific colleges. In his opinion the scientific students were, on the whole, an inferior body of men.

Professor Crane, speaking as a graduate of Princeton and therefore as one whose motives would not be misunderstood, suggested that by reason of a lower standard of admission the scientific school at Princeton gets, as its contingent, only those students who cannot be admitted to the academic department proper. Such a disposition of forces would be likely to bring together in this scientific school an inferior body of men.

President Angell inquired whether any universities took the ground that Doctors of Philosophy should above all be qualified to be successful teachers in their special line.

It was the opinion of those who took part in the discussion on this point that doctors should be successful teachers.

Professor Stringham: "It is unfortunate that the candidate should be obliged to spend any of his time in piecing out a deficient undergraduate training. Yet many graduate students begin their studies at California, with the doctor's degree in view, before they have fulfilled all our requirements for candidacy. We insist upon Latin equivalent to about four years' study of this subject in the high school and upon a reading knowledge of French and German. Many Bachelors of Letters and Bachelors of Science come to us with some or all of these studies omitted from their undergraduate programmes. We regard this as a great evil. These degrees, as given in many of our institutions, are distinctly inferior to the Bachelor of Arts degree.

"Our conditions for the doctor's degree call for two minor subjects, and we expect these to be chosen in studies closely allied to the major but in different university departments. Such a distribution of the candidate's work usually places him under the joint guidance of three professors representing different departments. It has happened in the past, however, that two of these professors represented the same department."

Professer Leuschner: "The ideal undergraduate course should above all fit the student for life in general, it should

also endow him with a thorough liberal culture both from the point of view of the classics and history and from that of the pure and the applied sciences, and lastly, it should furnish him with knowledge sufficient to enable him to specialize in any direction whatsoever. The course which, in my mind, comes nearest to meeting these requirements is that of the German 'Gymnasium.' It leads to any and all higher pursuits in life. But, although a graduate of one of Germany's leading 'Gymnasia,' I cannot help but feel that the 'Gymnasium' course has many defects, chief among which is its failure to develop to the highest degree the talents of the individual. There is a good reason why we could never adopt, in this country, a course like that of the 'Gymnasium.' It is simply that our American boy would never submit to the severe life of the German 'Gymnasiast.' There are other reasons, however, why I should not consider it wise to adopt the German system. Thus each college and university of this country finds itself called upon to solve the problem as best it can. Perhaps the main strength of our American system of education lies in the very diversity of the methods adopted in different institutions, but undoubtedly this diversity interferes to some extent with the free circulation of graduate students from one institution to another, especially of those who desire to proceed to a doctor's degree. Now is there any reason to believe that any one institution rather than any other has succeeded in discovering the correct way of dealing with the question? May we not consider the different solutions reached by really good institutions to be equivalent? What then should keep the individual member of this Association from giving to the bachelor's degree of its sisters in the Association the same recognition as a prerequisite to candidacy for a higher degree that it does to its own? The University of California would gladly coöperate in such a movement. It is the policy of the University of California to approve of any action that will secure in the various universities of the Association mutual recognition

of their bachelor's degrees as far as this is possible without interfering with high standards.

"No university, however, needs to waive the right of rejecting a graduate from another university in the Association, any more than we waive the right in California to deny one of our own graduates the privilege of proceeding to the doctor's degree if, in the opinion of the committee which supervises his work, he is not the ideal candidate for that honor, though he may have met all formal requirements.

"As regards the question asked by President Angell whether in turning out Doctors of Philosophy some or all of the universities here represented lay emphasis on the qualifications of the doctor as teacher, I believe that while we duly take care of that side of their preparation, we lay the greatest stress on turning out doctors who are capable of doing original work, and who will be leaders in their chosen field. In this connection I may add, that the Berkeley Astronomical Department, which sends students to the Lick Observatory for part of their graduate work, recommends for admission to the Lick Observatory only students who, in their Group Elective work, give evidence of exceptional qualifications as accurate observers and computers, and of ability for original research. Students who show only average ability are thus not encouraged to go on with astronomical studies and the same policy is observed in many other departments of the University,"

A very pleasant feature of the second annual meeting of the Association was the banquet given in honor of the delegates by the University Club of Chicago on Wednesday evening, February 27, 1901. The following toasts were responded to:

Special Training for Consular and Diplomatic Service—President James B. Angell, University of Michigan. The Three Years College Course—Professor LeBaron R. Briggs, Dean of Harvard College. Freedom of Speech in University Circles—Vice-President John C. Branner, Leland

Stanford Junior University. Religion and Science—Right Rev. Monsignor Conaty, Rector of the Catholic University of America. Shall Professional Schools Require for Admission the Bachelor's Degree?—Professor Ira Remsen, Johns Hopkins University. University Possibilities at Washington—Professor Nicholas Murray Butler, Columbia University.

These addresses will be printed by the University Club of Chicago. President Hadley was expected to respond to the toast Will College Class Feeling and Organization Sometime Disappear in Our Colleges? but was unable to be present.

The Association deliberately abstained from passing resolutions, or formulating policies, and up to the present time no action has been taken which hints at the abridgement of the rights, powers, or privileges of the individual members of the Association. It was even thought best not to suggest that any greater uniformity of procedure in relation to graduate instruction and the doctor's degree than already exists at the fourteen universities represented in the Association, should be urged at the present time.

The message of the Association to its members, therefore, is not a formulated judgment pronounced by a higher authority, but a bundle of items of information brought in from fourteen of the most important centres of higher educational activity, and pregnant with important suggestions concerning matters with which we are struggling at the present moment in our own University councils.

The delegates at the second conference were unanimous in the belief that the work of the Association has been well begun and that it should go forward, mainly upon the lines followed at the two conferences already held, by formulating its action at the successive meetings, rather than by a predetermined policy.

OFFICIAL ACTION.

At a meeting of the Regents, March 12, 1901, President Wheeler presented the following letter:

The Congregation Emanu-El of San Francisco, having recently celebrated the fiftieth anniversary of its founding, the ladies connected with that organization desire to establish a permanent memorial of the jubilee. They wish that memorial to take the form of one or two fellowships in the Semitic Department of the University of California, to be named the Emanu-El Fellowship in Semitic Languages, so that the name of the great Congregation they represent may in this manner remain identified with the progress of learning in California and on the Pacific Coast.

The time having been too short to raise the permanent endowment for these fellowships, I am authorized to tender you the amount of six hundred dollars, being five hundred dollars for the first year's stipend and one hundred dollars to provide such acquisitions as the Semitic Library may need at the present time.

I am assured that a similar amount for the purpose stated will be forthcoming from year to year, until the requisite endowment of fifteen thousand dollars will have been collected, which collection, I anticipate will be completed within the next two years.

I have the honor herewith to enclose my check for the amount, and if this contemplated foundation meets with your approval and the sanction of the Board of Regents, the Semitic Department will ask your consent to name the stipendiaries for the academic year commencing in August, 1901.

I have the honor to subscribe myself, Mr. President,

Very respectfully,

JACOB VOORSANGER,

Rabbi of Temple Emanu-El, Professor of Semitic Languages and Literatures in the University of California.

President Wheeler recommended a vote of thanks to the ladies of the Congregation Emanu-El for their wise and far-seeing generosity, and that the fellowships proposed be established when the endowment shall be completed. The recommendations were concurred in by the Regents.

At a meeting of the Regents, March 12, 1901, William Inch was appointed Reader in Greek; R. E. Gibbs, Reader in English; C. G. Dall, Assistant in the Lick Observatory; J. D. Maddrill, Student Assistant in the Students' Observatory; A. J. Cloud, Secretary of the Lick Observatory; George A. Merrill, Director of the Wilmerding School; Elwood Mead, Professor of the Institutions and Practices of Irrigation.

At a meeting of the Regents, April 9, 1901, Regent Wallace, chairman of the special committee appointed to consider the desirability of making an immediate settlement in the matter of the legacy bequeathed by the late Charles M. Hitchcock, recommended that the Regents sell and convey all the remainder or reversion in fee simple of the University in and to all of the property of the estate of Charles M. Hitchcock, deceased, for the sum of seven thousand five hundred dollars. The recommendation was adopted.

At a meeting of the Regents, April 19, 1901, the following were granted leaves of absence for the year 1901–2: Professors W. B. Rising, E. E. Brown, and C. B. Bradley.

At a meeting of the Academic Council held March 8, 1901, the Schedule Committee reported recommending that the regular lecture period be increased to one hour, and that the first period begin at eight o'clock a.m. On motion the report was adopted.

At a meeting of the Academic Council held April 5, 1901, the Committee on Schools reported in favor of permitting intrants to combine History (one unit) with Natural Science or Mathematics (one unit) for entrance to the College of Social Sciences, Natural Sciences, and Commerce; to offer any two of the subjects Latin 6, Latin 7, French, and German for entrance to the Colleges of Natural Sciences and Commerce; and to offer Spanish in lieu of French or German for entrance to the College of Commerce. The

Committee further recommended the approval of college courses in Latin A: Cicero's Orations, Virgil's Aeneid; and Latin B: Latin Composition; these courses, which are identical with matriculation subjects *7a* and *7b* to be counted for free elective work only in all colleges, subject to their regulations. The report of the committee was adopted at the meetings of April 5 and 10.

At a meeting of the Academic Council held April 5, on recommendation of the Committee on Regulations, the following regulation was adopted:

58. Every undergraduate student who intends to become a candidate for a degree must file with the Recorder of the Faculties a detailed schedule of studies offered for the degree sought. This schedule must be filed by Regular students at least six calendar months, by all other students at least one full academic year, before the date proposed for graduation, and must be approved by the Committee on Classification of Studies and Degrees of the college in which the student is enrolled.

At the same meeting, on recommendation of the same committee, the words "But no student with a deficiency will be advanced to Senior standing" in Regulation 40, and "of not less than six calendar months' standing" in Regulation 42 were struck out; and Regulations 51 and 54 were repealed.

CURRENT NOTES.

On March 18, a number of his friends and colleagues gave a banquet at the California Hotel, San Francisco, in honor of Professor F. G. Hesse, on the completion of the twenty-fifth year of his service as Professor of Mechanical Engineering in the University.

During the month of March Hon. John W. Foster delivered a course of five lectures at the University on The Practice of Diplomacy. Mr. Foster has served as Minister

to Mexico, Russia, and Spain, and as Secretary of State under President Harrison.

Following Mr. Foster, Mr. Eli T. Sheppard, formerly United States Consul at Chin Kiang and Tientsin, China, delivered four lectures on The American Consular Service.

These courses of lectures were secured by the University authorities in accordance with the desire of the University to build up a College of Commerce, and to make provision for the training of young men for diplomatic, consular, and business careers in foreign lands.

During April Director Campbell of the Lick Observatory lectured before the astronomical students of the University on "The Determination of the Motion of the Solar System from Observations made with the Mills Spectroscope" and "The New Star in Perseus"; and Astronomer Tucker, on "The Solar Parallax from Eros" and "The Position of Reference Stars for Eros."

The Lick Observatory has announced the publication of a bulletin, to be issued from time to time to bring to the attention of astronomers throughout the world important results achieved by the astronomers on Mount Hamilton. The bulletin is not intended to be a medium of publication for matter in final and detailed form; it will contain announeements of the more important discoveries and the publication of results whose usefulness depends upon prompt distrbution, and results unsuitable for journal publication which cannot await publication in journal form. The bulletin will be distributed to the principal observatories and institutions of learning of the world. The first number, published in March, contains some valuable meridian circle observations of reference stars for the planet Eros at opposition, 1900. It has been compiled by Astronomer R. H. Tucker. These results will be of great value in the campaign to determine the distance of the sun, in which the principal observatories of the world are now engaged.

The subordinates in the language and literature departments of the University organized in April a Philological Club, whose objects are stated in its constitution to be "to serve as a stimulus for the production of literary and philological papers and to promote comradeship among men of similar tastes and pursuits." Eight regular meetings are to be held each academic year, and at each two papers, as far as possible in different fields of philological work, are to be read. Each active member obligates himself to prepare at least one paper a year. At a meeting held April 10 the following were elected officers for the ensuing year: President, Wm. D. Armes, Assistant Professor of English Literature; Vice-President, Mr. C. R. Keyes, Instructor in German; Secretary-Treasurer, Dr. J. T. Allen, Instructor in Greek and Classical Archaeology. The first regular meeting at which papers will be presented will be held on the last Monday evening in August. The Club will begin work with an active and associate membership of about twenty-five.

President Benjamin Ide Wheeler has received an official notification of his appointment by the President as a member of the Board of Visitors for the West Point Military Academy. His coadjutors are Lieutenant-General Schofield, retired; Major-General Daniel E. Sickles, retired; St. Clair McKelway, New York; President Charles W. Eliot of Harvard University; William H. Upham, Wisconsin; St. George R. Fitzhugh, Virginia. It is the duty of the Board of Visitors to attend the annual examinations at the United States Military Academy, to inquire into the actual state of the discipline, instruction, police, administration, fiscal matters, and other affairs of the institution, and to report upon these matters to the Secretary of War for the information of Congress. The annual examinations will commence on Saturday, June 1.